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AUTHORITY

USAMRL ltr, 14 June 1971

AD

US ARMY MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY 40121

ANNUAL PROGRESS REPORT, FY 1967

RCS MEDDH-288(R1)

30 June 1967

UNITED STATES ARMY
MEDICAL RESEARCH AND DEVELOPMENT COMMAND

AD _____

HEADQUARTERS
US ARMY MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky 40121

ANNUAL PROGRESS REPORT, FY 1967

RCS MEDDH-288(R1)

30 June 1967

FY 1967 Projects:

3A013001A91C - In-House Laboratory Independent Research

3A014501A74D - Military Psychophysiological Studies

3A014501B71P - Basic Research in Support of Military Medicine

3A014501B71R - Research in Biomedical Sciences

3A014501B74C - Basic Research in Performance Effectiveness

3A025601A819 - Army Aviation Medicine

3A025601A821 - Combat Surgery

SUMMARY

The research and development effort at the US Army Medical Research Laboratory, Fort Knox, Kentucky, is devoted to psychological studies of the soldier; laser radiation; methodology relating to the collection, processing, preservation, shipment and transfusion of human blood; the health of laboratory animals; and detoxification of snake venom.

The progress during Fiscal Year 1967 and the current status of the various work units are reported herein.

FOREWORD

The work of the Blood Transfusion Division continued to expand, and during the last half of the year, a Blood Donor Center was established in order to carry out the additional mission of supplying quantities of whole blood to the military.

Accelerated laser research shows promise of opening new areas of increasing importance and value to the combat soldier. More intensive work is being directed toward establishment of safety thresholds.

Research involving snake venoms was somewhat reduced during FY 1967, with a part of the effort of the Biochemistry Division being redirected to studies involving blood chemistries.

The Experimental Psychology Division expanded its research in the Skill Analysis Branch to include testing of candidates for rotary wing pilot training. This work is being carried out in conjunction with Phase I training at Fort Wolters, Texas. Continued progress was made in the other research disciplines of this division, with recent developments in the audition field showing promise of considerable military significance.

Increased emphasis was placed on the study of diseases of laboratory animals, and initial work was begun on establishing acceptable "normal" values for blood chemistries, hematological values and blood groups of several laboratory animal species. The population of the animal colony increased and now totals approximately 4,000.

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Project No. 3A013001A91C	In-House Laboratory Independent Research
Task No. 00	In-House Laboratory Independent Research
Work Unit No. 149	Production of Polyvalent Antivenins

Investigators (FY 1967):

#149 W. F. Kocholaty, Ph.D.
M. Edith Ledford, A.B.
T. A. Billings, B.S.
Joyce C. Goetz, B.A.
B. D. Ashley, M.S.

RESEARCH AND TECHNOLOGY RESUME

2. GOVT ACCESSION	3. AGENCY ACCESSION: DA 0A 6100	REPORT CONTROL SYMBOL: CSCRD-103			
4. DATE OF RESUME: 01 07 67	5. KIND OF RESUME: C. TERMINATED 24 04 67	6. SECURITY: U (DOC) U (RES)	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61130011 3A013001A91C 00 149

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Production of Polyvalent Antivenins

12. SCIENTIFIC OR TECH AREA: 016800 Toxicology	13. START DATE: 07 66	14. CRIT. COMPL. DATE: NA	15. FUNDING AGENCY: OTHER DA

16. PROCURE. METHOD: C. In-House	17. CONTRACT/GRANT: a. NUMBER/TYPE: NA; c. DATE; d. AMOUNT	18. RESOURCES EST.: PROFESSIONAL MAN YEARS	19. FUNDS (In Thousands)
		PRIOR FY 66: 0	0
		CURRENT FY 67: 1	50

20a. GOVT LAB/INSTALLATION/ACTIVITY
NAME:
ADDRESS: Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20315
RESP. INDIV.: Forrester, COL R. H.
TEL: 502-41759

20b. PERFORMING ORGANIZATION
NAME: US Army Medical Res Laboratory
ADDRESS: Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL: Kocholaty, W. F., Ph.D.
ASSOCIATE: Ledford, M. E.
TEL: 502-44350 DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Detoxify; Venoms; Snakes, Poisonous; Immunization; Venoms, Biochemistry; Photosensitization; Methylene Blue

24. (U) Tech Objective - To detoxify venoms and other poisons without eliminating their immunogenic properties. To elucidate the enzymology, immunochemistry and chemistry of venoms and venom compounds.

25. (U) Approach - Venoms are attenuated by photooxidation. The resulting toxoids are tested for immunogenic response in rabbits and in goats. Chemical fractionation of various venoms is carried out.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - The comparison of the enzymology of Crotalid venoms was completed and extended to other species. The immunization schedule of goats with photooxidized coral snake venom was continued. Several batches of highly active immunoglobulin have been isolated so far. Experiments designed to investigate the influence of the route of administration of various venoms in relation to protection by immune sera in mice revealed that the route of administration is of decisive importance in the demonstration of the protective effect of an antivenin and that it will vary with the type of venom (hemorrhagic-necrogenic or neurotoxic) under study.

27. COMMUNICATIONS SECURITY: ☐ a. COMSEC INFO ☐ b. COMSEC RELATED ☐ c. NOT COMSEC RELATED	28.	29. CSD CODE: AR	30. BUDGET CODE: 1
31. MISSION OBJECTIVE: NA		32. PARTICIPATION: NA	
33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT		
34. EST. FUNDS (In thousands) CY+1	35.		

DD FORM 1 AUG 64 1498A (Items 1 to 35 identical to NASA Form 1152)

A91C 00 149 (cont)

Detail Sheet # 1

(U) Progress:

Several γ-globulins isolated from rabbits following identical immunization schedules with photochemically detoxified venoms gave varying degrees of protection in mice against the unaltered venoms (Crotalus durissus durissus, Bothrops atrox asper, Naja naja). Investigation of these discrepancies in protective action revealed that the route of administration has a decisive influence in the demonstration of the protective effect of a given antivenin. In order to arrive at a rational appraisal of the efficacy of an immune serum, both I. V. and I. P. administration should be given consideration at least as long as one is uncertain of the chemical nature, pharmacological activity and toxicity of the variety of components contained in the venom.

A study of enzymatic activities and toxicities of some thirty representatives of the families of Elapidae, Viperidae and Crotalidae is nearing completion. Electrophoretic separation of these venoms was carried out with the purpose to correlate electrophoretic patterns with enzymatic characteristics and toxicities. Immunoelectrophoretic studies of several venoms were undertaken to characterize certain venom components.

Large-scale separation of C. atrox venom resulted in an accumulation of four distinct fractions with distinct toxic, enzymatic and pharmacological characteristics.

Publications and/or Presentations:

Billings, T. A. A holder to facilitate the intravenous injection of mice. USAMRL Report No. 704, 1966 (DDC AD No. 645927).

Kochclaty, W., B. D. Ashley and T. A. Billings. An immune serum against the North American coral snake (Micrurus fulvius fulvius) venom obtained by photooxidative detoxification. USAMRL Report No. 699, 1966 (DDC AD No. 645108); Toxicon, 5: 43-46, 1967.

Kocholaty, W., T. A. Billings, B. D. Ashley, M. Edith Ledford and Joyce C. Goetz. Effect of the route of administration on the neutralizing potency of antivenins. USAMRL Report No. 745, 1967.

A9.C 00 149 (cont)

Detail Sheet # 2

Kocholaty, W., Joyce C. Goetz, B. D. Ashley, T. A. Billings and M. Edith Ledford. Immunogenic response of the venoms of fer-de-lance (Bothrops atrox asper) and Lacascabella (Crotalus durissus durissus) following photooxidative detoxification. USAMRL Report No. 743, 1967.

Kocholaty, W., M. Edith Ledford, T. A. Billings, Joyce C. Goetz and B. D. Ashley. Immunization studies with Naja naja venom detoxified by photooxidation. USAMRL Report No. 744, 1967.

Selected Bibliography:

Weil, L., W. G. Gordon and A. R. Buchert. Photooxidation of amino acids in the presence of methylene blue. Arch. Biochem. Biophys. 33: 90, 1951.

Kaiser, E. and H. Michl. Die Biochemie der tierischen Gifte. Franz Deuticke Wien, 1958.

Project No. 3A014501A74D	Military Psychophysiological Studies
Task No. 00	Military Psychophysiological Studies
Work Unit No. 020	Psychophysics of Visual Perception
Work Unit No. 022	Biomechanical Aspects of Performance and Performance Decrement

Investigators (FY 1967):

#020 G. S. Harker, Ph. D.
I. Behar, Ph. D.
D. L. Kohfeld, Captain, MSC

#022 L. S. Caldwell, Ph. D.
A. J. Lloyd, Captain, MSC
G. S. Harker, Ph. D.
D. L. Kohfeld, Captain, MSC

RESEARCH AND TECHNOLOGY RESUME		2. GOV'T ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6081	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY RPT	SEC	7. DOWNGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U	U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
61145011 3A014501A74D 00 020	NO CHANGE

11. TITLE:
(U) Psychophysics of Visual Perception

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
013400 Psychology (individual and group behavior)	08 50	NA	OTHER (DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	2	50
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Hedlund, LTC James L.	INVESTIGATORS PRINCIPAL ASSOCIATE Harker, G. S., Ph. D. Behar, I., Ph. D.
TEL. 202-OX 66670	TEL 502-42348 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS Perception; Discrimination; Vision; Binocular; Stereoscopic; Form; Eye; Physiological Optics

24. (U) Tech Objective - To understand the binocular visual function as it relates to visual performance in stereoscopic vision, binocular depth perception, form discrimination, and to the underlying neural, muscular, and CNS components. This understanding to be utilized in the development and employment of military vision devices.

(U) Approach - The time interval separating the stimulation of corresponding retinal points on the two retinas, intensities, and repetition intervals will be investigated as will stimulus configurations which induce cyclorotation and influence the operation of the equidistance tendency to determine the interaction of cues to depth in determining the perceived depth location of the objects. Vertically and laterally displaced binocular viewing devices will be used to place in sharp relief the process of binocular viewing.

(U) Progress (1 Apr 67 - 30 Jun 67) - The saccadic suppression paradigm for the Pulfrich phenomenon was presented for the meeting of the Midwestern Psychological Association. An 1872 reference has been located in which the episcotister was used to generate depth displacement of an oscillating pendulum. Visual acuity determinations are being obtained in three species of Old World monkeys (baboons, mangabeys, and rhesus) with varying target size over a wide range of luminances. Behar, I. and J. S. Warm. Effect of electrocutaneous ready-signal variation on visual reaction-time. USAMRL Rep. No. 731, 31 May 67; Gettys, C. F. and G. S. Harker. Some observations and measurements of the Panum phenomenon. USAMRL Rep. No. 722, 13 Apr 67 (AD 649882); Harker, G. S. and O. L. O'Neal, Jr. Some observations and measurements of the Pulfrich phenomenon. USAMRL Rep. No. 728, 9 May 67.

27. COMMUNICATIONS SECURITY	28.	29. DOD CODE	30. BUDGET CODE
☐ CRYPTO RELATED ☒ NOT CRYPTO RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. ELT. FUNDS (In thousands)	
CPFF	

DD FORM 1 AUG 64 1498A (Items 1 to 26 identical to NASA Form 1332)

A74D 00 020 (cont)

Detail Sheet # 1

(U) Progress:

Response to the saccadic suppression paradigm by the professional community has been excellent. Several individuals have written for further clarification and indicated the intent to initiate follow-on experimentation. A review of current practice in handling amblyopia through the use of cycloplegic drugs has suggested the possibility that an optical system to reduce the interpupillary distance could facilitate the process and the development of stereoscopic vision be induced by the use of the Pulfrich pendulum and its associated filter.

The effects of variation of an electrocutaneous ready-signal upon visual reaction-time were determined. Reaction times were short when the visual signals followed electrocutaneous offset, longer where they followed onset.

The acuity of the baboon and rhesus are comparable while that of the mangabey is inferior. However, the mangabeys tested were older than the other species. To determine whether the finding is a true species difference or one of age, additional young mangabeys are being trained.

Publications and/or Presentations:

Behar, I. Response latency in simian learning set performance. Psychol. Rep. 19: 403-406, 1966; USAMRL Report No. 697, 1966 (DDC AD No. 645077).

Behar, I. and C. K. Adams. Some properties of the reaction-time ready-signal. Amer. J. Psychol. 79(3): 419-426, 1966; USAMRL Report No. 706, 1966 (DDC AD No. 645966).

Behar, I. and J. S. Warm. Effects of electrocutaneous ready-signal variation on visual reaction-time. USAMRL Report No. 731, 1967 (DDC AD No. 652887).

Gettys, C. F. and G. S. Harker. Some observations and measurements of the Panum phenomenon. USAMRL Report No. 722, 1967 (DDC AD No. 649882).

A74D 00 020 (cont)

Detail Sheet # 2

Harker, G. S. Military operations, human capacities and equipment compromises. Presented at the Man/Mobility/Survival Forum, Allison Division, General Motors, Indianapolis, Ind., 11-12 Apr 1967.

Harker. G. S. A saccadic suppression explanation of the Pulfrich phenomenon. USAMRL Report No. 718, 1967 (DDC AD No. 648-389); presented at the Midwestern Psychological Association meeting, Chicago, Ill., 4-6 May 1967.

Harker, G. S. and O. L. O'Neal, Jr. Some observations and measurements of the Pulfrich phenomenon. USAMRL Report No. 728, 1967 (DDC AD No. 652705).

Selected Bibliography:

Brown, J. L., C. H. Graham, H. Leibowitz, and H. B. Ranken. Luminance thresholds for the resolution of visual detail during dark adaptation. J. Opt. Soc. Amer. 43: 197-202, 1953.

Coate, W. B. Monitoring visual acuity in the rhesus monkey. Proceedings of a Contractors' Conference on Behavior Sciences. Special Publication EASP-100-11, Feb 1967, Edgewood Arsenal.

Dvorak, V. Über Analoga der persönlichen Differenzen zwischen beiden Augen und den Netzhautstellen desselben Auges. S. B. böhm. Ges. Wiss. 1872, 65-74.

Yarczower, M., et. al. Visual acuity in a stumptail macaque. Science, 152: 1392-1393, 1966.

RESEARCH AND TECHNOLOGY RESUME					
		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6083	CSCRD-103
4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE
61145011 3A014501A74D 00 022

10b. PRIOR NUMBER/CODE
NO CHANGE

11. TITLE:
(U) Biomechanical Aspects of Performance and Performance Decrement

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
007500 Human Factors Engineering	01 56	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	2	90
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY
NAME: Headquarters
ADDRESS: US Army Medical Res & Dev Command
Washington, D. C. 20315
RESP. INDIV. Hedlund, LTC James L.
TEL 202-OX 66670

20. PERFORMING ORGANIZATION
NAME / ADDRESS: US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE: Caldwell, L. S., Ph. D.
Lloyd, CPT A. J.
Harker, G. S., Ph. D.
TEL 502-43354 TYPE DA

21. TECHNOLOGY UTILIZATION
NA

22. COORDINATION
NA

23. KEYWORDS: Psychology, Experimental; Performance Decrement; Human Factors; Endurance; Drug Effects; Hand Ergonometry; Individual Differences; Work

24. (U) Tech Objective - To develop techniques to measure human strength and endurance in heavy work situations, study factors in work situation (control design, body positions, supports, etc.) which influence efficiency, derive general principles which would help in understanding and predicting work efficiency, study the contribution of personality factors to individual differences in susceptibility to performance decrement.

25. (U) Approach - Electrophysiological research is aimed at validating the EMG as a measure of effort or effective load, and resistance to joint rotation is being varied externally to determine its effects on the accuracy of estimating static joint position.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Studies relating subjective estimates of effort to variations in relative loading with normal and occluded circulation to the muscles have shown that effort ratings are sensitive to variations in the load, and that at minimum load of 60% to 70%, maximum strength external occlusion of the blood supply has no effect on endurance or the effort ratings, indicating that these tensions produce occlusion of the blood supply.

Caldwell, L. S. and R. P. Smith, Subjective estimation of effort, reserve, and ischemic pain. USAMRL Rep. No. 730, 12 May 67.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. COMSEC RELATED ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CF 441	

DD FORM 1 AUG 65 1498A (Items 1 to 36 identical to NASA Form 1352)

A74D 00 022 (cont)

Detail Sheet # 1

(U) Progress:

Studies of the effects of repeated static work sessions on performance have shown that the primary determinant of work decrement was the length of the work session, and that for a fixed session length the decrement per trial was relatively constant. Furthermore, recovery from the effects of work was not systematically related to the length of the rest period after the first or second period. Ratings of the effort required to maintain a work load were shown to vary systematically with changes in the load and in the circulatory state of the muscles. In summary, variables which affected endurance were shown to have a commensurate effect upon subjective assessment of the effort required by the task. Thus, the effort scaling procedure may prove useful as a device for assessing reserve capacity well in advance of the point at which the task demands exceed the physical capabilities of the individual and performance is necessarily terminated. Data has been collected on the effect of information feedback and muscle tension on kinesthetic estimation of limb position. Preliminary analyses indicate that individuals given increased knowledge of results overcompensate and the magnitude of the position error does not decrease. There is preliminary evidence of an optimal muscle tension which results in increased kinesthetic precision.

Publications and/or Presentations:

Caldwell, L. S. Laboratory demonstration - dynamometry. Presented at Ergonomics Course, Occupational Health Research and Training Facility, Public Health Service, Cincinnati, Ohio, 15 May 1967.

Caldwell, L. S. and R. P. Smith. Pain and endurance of isometric muscle contractions. J. engng. Psychol. 5(1): 25-32, 1966; USAMRL Report No. 709, 1966 (DDC AD No. 645965).

Caldwell, L. S. and R. P. Smith. Subjective estimation of effort, reserve, and ischemic pain. USAMRL Report No. 730, 1967.

Harker, G. S. Subject controlled treadmill. Presented at the Twelfth Annual Army Human Factors R and D Conference, Fort Benning, Ga., 3-4 Oct 1966.

A74D 00 022 (cont)

Detail Sheet # 2

Holmgren, G. L. Characteristic pace - a potential tool for vascular surgeons. USAMRL Report No. 687, 1966 (DDC AD No. 647537).

Holmgren, G. L. Speaker recognition, speech characteristics, speech evaluation and modification of speech signal--a selected bibliography. IEEE Transactions on Audio and Electroacoustics, AU-14(1): 32-39, 1966; USAMRL Report No. 692, 1966 (DDC AD No. 645074).

Holmgren, G. L. and G. S. Harker. Characteristic pace as determined by the use of a tracking treadmill. J. appl. Psychol. 51: 278-283, 1967; USAMRL Report No. 685, 1966 (DDC AD No. 645454).

Lloyd, A. J. The occurrence of synkinesis during kinesthetic positioning responses. USAMRL Report No. 720, 1967.

Smith, R. P. and L. S. Caldwell. Psychophysical studies of muscular effort, endurance and ischemic pain. Presented (by Smith) at Psychonomic Society meeting, St. Louis, Mo., 27-29 Oct 1966.

Warm, J. S., R. P. Smith, and L. S. Caldwell. Effects of induced muscle tension on judgments of time. Presented (by Warm) at Southern Society for Philosophy and Psychology meeting, Roanoke, Va., 23-25 Mar 1967.

Selected Bibliography:

Albe-Fessard, D., J. Liebeskind, and Y. Lamarre. Projection au niveau du cortex somato-moteur du Singe d'afférences provenant des recepteurs musculaires. C. R. Acad. Sci., Paris, 261: 3891-3894, 1965.

Bartley, S. H. Fatigue: Mechanism and Management. Springfield, Ill.: Charles C. Thomas, 1965.

Beecher, H. K. Pain: One mystery solved. Science, 151: 840-841, 1966.

Evans, W. O. A titration schedule on a treadmill. J. Exper. Anal. Behav. 6: 219-221, 1963.

A74D 00 022 (cont)

Detail Sheet # 3

Muscio, B. Is a fatigue test possible? Brit. J. Psychol. 12: 31-46, 1921.

Rohmert, W. Ermittlung von Erholungspausen für statische Arbeit des Menschen. Arbeitsphysiol. 18: 123-164, 1960.

Project No. 3A014501B71P	Basic Research in Support of Military Medicine
Task No. 01	Biochemistry
Work Unit No. 045	Biochemistry of Corticosteroid Hormones, Proteins, and Nucleic Acids
Work Unit No. 046	Mechanism of Fibrinolysis
Task No. 02	Biophysics
Work Unit No. 010	Models and Mechanisms of the Effects of Laser Radiation on Biological Systems
Work Unit No. 013	Cellular Effects of Laser Radiation
Task No. 08	Physiology
Work Unit No. 085	Psychophysiology of Vision
Work Unit No. 086	Vestibular Function and Disorientation
Work Unit No. 087	Chloroquine Retinopathy
Task No. 10	Zoology
Work Unit No. 021	The Pathology of Animal Diseases of Military Significance
Work Unit No. 023	Immunology, Toxicology and Hematochemistry of Venoms

Investigators (FY 1967):

#045 F. DeVenuto, Ph. D.
R. J. G. Lange

#046 J. L. Bobbitt, Ph. D.
J. L. Gray, B.S.

#010	A. S. Brownell, Ph. D. F. A. Verser, Lt Colonel, MSC Dorothy M. Witt, M.S.
#013	E. S. Spoerl, Ph. D. R. J. Doyle, Ph. D. G. H. Herbener, M.S.
#085	C. K. Adams, Captain, MSC G. S. Harker, Ph. D. J. N. Cronholm, M.S. J. L. Hatfield, Major, MSC E. B. McClaskey, M.S.
#086	J. E. Marshall, Captain, MSC J. W. Wolfe, Ph. D.
#087	A. H. Bryan, Captain, MC C. K. Adams, Captain, MSC R. W. Bull, Captain, VC E. B. McClaskey, M.S.
#021	D. K. Hysell, Captain, VC R. S. Dedrick, Captain, VC R. W. Bull, Captain, VC A. J. Neves, Captain, VC G. H. Herbener, M.S.
#023	W. F. Kocholaty, Ph. D. D. E. Reed, Captain, MSC B. D. Ashley, M.S. M. Edith Ledford, A.B. T. A. Billings, B.S. Joyce C. Goetz, B.A.

RESEARCH AND TECHNOLOGY RESUME

1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
		DA 0A 6070	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
24 07 67	D. CHANGE 01 07 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER CODE
62156011 3A025601A821 00 170	61145011 3A014501B71P 01 045

11. TITLE:
(U) Biochemistry of Corticosteroid Hormones, Proteins, and Nucleic Acids

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002300 Biochemistry	11 63	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	42
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE DeVenuto, F., Ph. D. Ligon, D. F.
TEL. 202-OX 66082	TEL 502-42053 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS
Hormones; Endocrinology; Biosynthesis; Polyribosomes

24.
(U) Tech Objective - To investigate whether the interaction between corticosteroid hormones and nuclei or mitochondria from rat liver is dependent on the structural integrity of these subcellular fractions and also to single out any specific biological structure responsible for the interaction.

25.
(U) Approach - Nuclei and mitochondria from rat liver cell were prepared by differential centrifugation and subjected to sonoration. Several fractions were obtained and tested for their binding affinity to cortisol and corticosterone by continuous flow electrophoresis and multiple equilibrium dialysis techniques.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Nuclei and mitochondria prepared from rat liver cells show a definite activity in protein synthesis in an in vitro system. This activity is less than that obtained with polyribosomes from the same cells. If the preparations are obtained from the liver cells of animals deprived of their endogenous production of corticosteroids, the ability to synthesize protein increases. The concentration of Mg is very critical in the system used for such studies.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
FY 68	

DD FORM 1 AUG 64 1498A (Items 1 to 16 identical to NASA Form 1125)

B71P 01 045 (cont)

Detail Sheet # 1

(U) Progress:

Rat liver nuclei were separated in five fractions and they interact differently with corticosterone. The acid protein and the globulin fraction show the highest binding. A very small amount of steroid is associated with the histone fraction. In the mitochondrial fractions, the uptake of cortisol or corticosterone is associated almost entirely with the particulate fractions. Three electrophoretic peaks are obtained from mitochondria and two of these peaks display combining affinity for corticosterone. The disruption of the subcellular fractions does not destroy their binding affinity for corticosteroid hormones.

Publications and/or Presentations:

DeVenuto, F. Interaction of progesterone and aldosterone with red blood cells of the rat. USAMRL Report No. 677, 1966 (DDC AD No. 645109); Proc. Soc. Exper. Biol. and Med. 124: 478, 1967.

DeVenuto, F. and G. Chader. Interactions between cortisol or corticosterone and fractions of rat thymus, brain and heart cell. Biochim. Biophys. Acta, 121: 151, 1966.

DeVenuto, F. and R. J. G. Lange. Amino acid incorporation by fractions of liver cells from normal and adrenalectomized rats. USAMRL Report No. 703, 1966 (DDC AD No. 645453).

DeVenuto, F. and R. J. G. Lange. Effect of adrenalectomy on amino acid incorporation into protein by cell-free preparation from liver and kidney of rats at various time after the operation. Biochim. Biophys. Acta, 134: 443, 1967.

DeVenuto, F. and R. J. G. Lange. Effect of corticosteroids on amino acid incorporation into protein by rat liver ribonucleoprotein particles. Proc. Soc. Exper. Biol. and Med. 124: 793, 1967.

DeVenuto, F. and T. Muldoon. Interactions between corticosteroids and fractions of mitochondria and nuclei from normal rat liver cells. USAMRL Report No. 674, 1966 (DDC AD No. 806463).

Detail Sheet # 2

Selected Bibliography:

Korner, A. The role of the adrenal gland in the control of amino acid incorporation into protein of isolated rat liver microsomes. J. Endocrinol. 21: 177, 1960.

Liao, S. and H. G. Williams-Ashman. An effect of testosterone on amino-acid incorporation by prostatic ribonucleoprotein particles. Proc. N.A.S. 48: 1956, 1962.

Florini, J. R. and C. B. Brewrer. Amino acid incorporation into protein by cell-free preparation from rat skeletal muscle. III. Comparison of activity of muscle and liver ribosomes. Biochemistry, 4: 253, 1965.

Pena, A., B. Dvorkin, and A. White. Acute effect of a single in vivo injection of cortisol on in vitro amino acid incorporating activity of rat liver and thymic preparations. J. Biol. Chem. 241: 2144, 1966.

RESEARCH AND TECHNOLOGY RESUME			2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 6071	CSCRD-103
4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
24 07 67	D. CHANGE 01 07 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A025601A821 00 171

10b. PRIOR NUMBER/CODE: 61145011 3A014501B71P 01 046

11. TITLE: (U) Mechanism of Fibrinolysis

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002300 Biochemistry	12 64	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST. a. PROFESSIONAL MAN-YEARS	b. FUNDS (In Thousands)
C. In-House	NA	PRIOR FY 67: 1	38
		CURRENT FY 68:	

19. GOVT LAB INSTALLATION/ACTIVITY
NAME
ADDRESS: Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20315
RESP. INDIV: Rose, LTC L. R.
TEL: 202-OX 66082

20. PERFORMING ORGANIZATION
NAME
ADDRESS: US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE: Kocholaty, W. F., Ph. D.
Gray, J. L.
Ashley, B. D.
TEL: 502-44350 TYPE: DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Fibrinolysis; Fibrinolysin; Plasmin; Streptokinase; Activation

24.

25. (U) Tech Objective - To determine the chemical reactions which take place during the activation of plasminogen to plasmin, thus increasing understanding of dissolution and prevention of blood clots.

26. (U) Approach - Adequately purified plasminogen and plasmin, activated by streptokinase or urokinase, will be subjected to gel filtration and N-terminal analyses to detect changes in the primary structure of the molecule. Split products, if any, will be separated and characterized by their amino acid composition.

27. (U) Progress (1 Apr 67 - 30 Jun 67) - The technique of upward flow on Sephadex gel columns has been adapted to the preparative columns employed in obtaining plasminogen and plasmin free of low molecular weight material and suitable for studies on the activation process. The ratio of activator to enzyme precursor influences the process and varying amounts of streptokinase have been employed in activation mixtures to provide low molecular weight products for examination by amino acid analysis.

29. COMMUNICATIONS SECURITY	30.	31. DOD CODE	32. BUDGET CODE
a. COMSEC RELATED ☒ b. NOT RELATED		BR	1

33. MISSION OBJECTIVE	34. PARTICIPATION
NA	NA

35. REQUESTING AGENCY	36. SPECIAL EQUIPMENT

37. EST. FUNDS (In thousands) CPFF	38.

DD FORM 1 AUG 64 1498A (Items 1 to 26 identical to NASA Form 1832)

B71P 01 046 (cont)

Detail Sheet # 1

(U) Progress:

Mixtures of plasminogen and varying amounts of streptokinase were separated by gel filtration and the apparent split products examined by use of a peptide survey system. Partially separated products of activation were subjected to amino acid analysis.

Studies employing N-terminal amino acid analyses of plasminogen, plasmin and activation mixtures of the proenzyme indicated that the gel filtration process may leave a number of contaminating proteins or peptides in the preparations examined. The technique of upward flow on Sephadex G-200 columns was adapted to the preparative-size column and used in obtaining plasminogen and plasmin of suitable purity for studies on the activation process. This system also provided a separation of the low molecular weight split products produced in the activation of plasminogen by streptokinase.

A peptide survey system incorporating a Bio-Gel P-2 column was utilized to examine the separated low molecular weight constituents. The presence of substances the size of amino acids, dipeptides and tripeptides has been reasonably well established, but a constituent with a molecular weight above 2,000 remains to be characterized.

It would appear that the ratio of activator to enzyme precursor has an important influence on the process of activation and the appearance of any split products, therefore, varying amounts of streptokinase purified by gel filtration have been used in activation mixtures. The split products are being separated by column chromatography for determination of molecular weight and amino acid composition. Preliminary studies on the amino acid content show presence of lysine and alanine with smaller amounts of arginine, histidine and glutamic acid.

Publications and/or Presentations:

Bobbitt, J. L. Factors affecting resolution and reproducibility of gradient elution automatic amino acid chromatograms. USAMRL Report No. 693, 1966 (DDC AD No. 645925).

B71P 01 046 (cont)

Detail Sheet # 2

Bobbitt, J. L. and D. E. Reed. Differentiation between proteolytic and TAME esterolytic activity in Crotalus atrox venom. USAMRL Report No. 712, 1966 (DDC AD No. 647148); presented (by Reed) at the Southeastern Regional Meeting of the American Chemical Society, Louisville, Ky., 27-29 Oct 1966.

Wabner, C. I., J. L. Gray and W. F. Blatt. Influence of sex and thyroid principles on the antiproteolytic activity of rat serum. Thromb. Diath. Haem. 16: 86, 1966.

Selected Bibliography:

Robbins, K. C., L. Summaria, B. Hsieh and R. J. Shah. The peptide chains of human plasmin. Mechanism of activation of human plasminogen to plasmin. J. Biol. Chem. 242: 2333, 1967.

De Renzo, E. C., E. Boggiano, W. F. Barg, Jr. and F. F. Buck. Interaction of streptokinase and human plasminogen. J. Biol. Chem. 242: 2428, 1967.

Taylor, F. B., Jr. Purification and characterization of streptokinase and its interaction with plasminogen. Fed. Proc. 26: 647, 1967.

RESEARCH AND TECHNOLOGY RESUME			2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 6072	CSCRD-103
4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61145011 3A014501B71P 02 010

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Models and Mechanisms of the Effects of Laser Radiation on Biological Systems

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	11 62	NA	OTHER | DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	3	64
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY
NAME
ADDRESS Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20315
RESP. INDIV. Rose, LTC L. R.
TEL 202-OX 66082

20. PERFORMING ORGANIZATION
NAME
ADDRESS US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE Brownell, A. S., Ph. D.
Peacock, CPT G. R.
Verser, LTC F. A.
TEL 502-45149 TYPE DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Nucleic Acids; Enzymes; DNA; Laser; Radiation; Biophysics

24.

(U) Tech Objective - To isolate and study the various processes of interaction of laser radiation with molecular and subcellular systems in order to understand the biological effects of this radiation.

25. (U) Approach - The initial approach will be to determine the power density and pulse length necessary to produce detectable changes in the molecular structure of selected molecular species. Accurate dosimetry techniques necessary to determine whether the induced changes are thermal or athermal will be developed. The molecular changes produced by laser radiation as a function of such parameters as power density, pulse length, frequency, coherency, etc., will be investigated.

(U) Progress (1 Apr 67 - 30 Jun 67) - Study of the thermal denaturation of the intracellular microbial enzyme β-galactosidase by 10.6 micron laser radiation has been continued. The denaturation of this enzyme as a function of time of exposure has been determined for a total of five power densities of radiation. The experiments are designed to evaluate the relations necessary to construct a mathematical model adequate to describe threshold thermal injuries.

27. COMMUNICATIONS SECURITY	28.	29. DOD CODE	30. BUDGET CODE
☐ CLASS. RELATED ☒ NOT CLASS. RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT
35. EST. FUNDS (In thousands) CFY+1	36.

DD FORM 1498A (Items 1 to 36 identical to NASA Form 1222)

B71P 02 010 (cont)

Detail Sheet # 1

(U) Progress:

During the first three quarters of FY 1967, the thermal denaturation of the intracellular microbial enzyme β-galactosidase by 10.6 micron laser radiation as a function of time of exposure was determined for two power densities of radiation. The experiments were designed to evaluate the relations necessary tc construct a mathematical model adequate to describe threshold thermal injuries.

Publications and/or Presentations:

None.

Selected Bibliography:

Henriques, F. C. Studies of thermal injury. AMA Arch. Pathol. 43: 489-502, 1947.

Mixter, G., Jr., G. P. DeLhery, W. L. Derksen, and T. I. Monahom. The influence of time on the death of Hela cells at elevated temperature. Temperature, Its Measurement and Control in Science and Industry, New York: Reinhold Publishing Corp., Part 3, 1962, pp. 177-182.

Fugitt, C. H. A rate process theory of thermal injury. AF Special Weapons Project Report No. 606, 1955 (DDC AD No. 212660).

Vor, J. J. A theory of retinal burns. Bull. Math. Biophysics, 24: 115-128, 1962.

Fine, S., W. P. Hansen, G. R. Peacock, E. Klein, F. Hust, and Y. Laor. Biophysical studies with the CO_2 laser. NEREM (IEEE) Record, p. 166, 1966.

Wood, T. H. Lethal effects of high and low temperatures on unicellular organisms. Adv. Biol. Med. Physics, 4: 119-165, 1956.

Davies, J. M. The effect of intense thermal radiation on animal skin. A comparison of calculated and observed burns. Quartermaster

B71P 02 10 (cont)

Detail Sheet # 2

Research and Engineering Command Report T-24, 1959 (DDC AD No. 456794).

Davis, T. P. A theoretical and experimental investigation of the temperature response of pig skin exposed to thermal radiation. University of Rochester Atomic Energy Project Report UR-553, 1959.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	4. REPORT CONTROL SYMBOL
			DA 0A 6076	CSCRD-103

5. DATE OF RESUME	6. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U RPT U TITLE	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
61145011 3A014501B71P 02 013	NO CHANGE

11. TITLE
(U) Cellular Effects of Laser Radiation

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	07 62	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. AMOUNT	18. RESOURCES EST. a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67: 1	36
		CURRENT FY 68:	

19. GOVT LAB INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE Spoerl, E. S., Ph. D.
TEL 202-OX 66082	TEL 502-47145 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS Laser; Physiology, Cell; Biology, Molecular; Cell Division; Radiobiology; Carbohydrate Metabolism; Active Transport; Cornea

24. (U) Tech Objective - To examine specific cellular reactions and structures which are altered by laser light and other electromagnetic radiations with the object of increasing the limited knowledge of key biochemical and physiological occurrences resulting from absorption of such radiation.

25. (U) Approach - Cell processes and structures selected for the suitability of their radiation responses will be examined by various techniques. Effects upon sugar transport and catabolism and upon cell division will be studied. Measurements of short circuit current, electrical resistance and transmembrane potential difference, as well as radioisotope distribution, will be used to examine alterations induced in electrolyte transport of in vitro frog corneal and skin preparations.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Studies designed to localize and describe a metabolic site in yeast cells involved in the regulation of CO_2 output and affected by heat and radiation have been continued with comparisons of CO_2 production and of sugar uptake and efflux in log phase and mature phase cells. CO_2 production is reduced much less in mature cells than in log phase cells by starvation. The amount of sugar retention or binding appears to be correlated with CO_2 output as it was when output was stimulated by including certain sugars and hexitols with the cells during a starvation period.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. COMSEC OR COMSEC RELATED ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPYR	

DD FORM 1 AUG 64 1498A (Items 1 to 26 identical to NASA Form 3133)

B71P 02 013 (cont)

Detail Sheet # 1

(U) Progress:

Studies of the effects on CO_2 output brought about by incubation of cells in various sugars or hexitols were carried out during the early part of the year. Certain of these compounds evidently affect sites also affected by increased temperatures such as laser irradiation generates. Measurements of cofactors in extracts of these cells showed no correlation between NAD levels and the incubating sugar, or CO_2 production. ATP content was generally below average in cells with low CO_2 output. A greatly decreased decarboxylase activity occurred in some cells primarily due to enzyme loss or inhibition rather than to a thiamine pyrophosphate lack. Sugar efflux from these cells showed no differences in rates of facilitated diffusion, but cells with a high CO_2 output were able to bind or compartment, and thus retain, more sorbose.

Publications and/or Presentations:

Doyle, R. J. and E. Spoerl. Sugar retention, cofactor levels and leakage of metabolites in X-irradiated, starved yeast cells. USAMRL Report No. 742, 1967.

Spoerl, E. and R. J. Doyle. The influence of some hexitols and sugars on CO_2 production by starved and X-irradiated, starved yeast cells. USAMRL Report No. 682, 1966 (DDC AD No. 645204).

Spoerl, E. and R. J. Doyle. Modification by hexitols and sugars of changes induced in yeast by starvation. I. Differences in CO_2 production, O_2 use and viability. USAMRL Report No. 726, 1967.

Spoerl, E. and R. J. Doyle. Modification by hexitols and sugars of changes induced in yeast by starvation. II. Cellular depletions and sugar binding. USAMRL Report No. 727, 1967 (DDC AD No. 652704).

Selected Bibliography:

Photophysiology. A. C. Giese (Ed.), Vols. I and II, New York: Academic Press, 1964.

Green, D. E., E. Murer, H. O. Hultin, S. H. Richardson, B. Salmon, G. P. Brierly and H. Baum. Association of integrated metabolic pathways with membranes. I. Glycolytic enzymes of the red blood corpuscle and yeast. Arch. Biochem. Biophys. 112: 675, 1965.

RESEARCH AND TECHNOLOGY RESUME		3. GOVT ACCESSION	4. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA OA 6084	CSCRD-103

5. DATE OF RESUME	6. KIND OF RESUME	6. SECURITY	7. HANDLING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A.WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
61145011 3A014501B71P 08 085	NO CHANGE

11. TITLE:
(U) Psychophysiology of Vision

12. SCIENTIFIC OR TECH AREA	13. START DATE	14. CMPT. COMPL. DATE	15. FUNDING AGENCY
012000 Optics 005900 Environmental Biology 012900 Physiology	09 63	NA	OTHER | DA

16. PROCURE. METHOD	17. CONTRACT/GRANT		18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
	a. NUMBER	c. DATE	PRIOR FY 67	2	67
C. In-House	b. TYPE NA	d. AMOUNT	CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME US Army Medical Res Laboratory
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS Fort Knox, Ky. 40121
RESP. INDIV. Hedlund, LTC James L.	INVESTIGATOR PRINCIPAL Adams, CPT C. K.
TEL 202-OX 66670	ASSOCIATE Harker, G. S., Ph. D. Cronholm, J. N.
	TEL 502-43354 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS Neural Mechanisms; Optic Nerve; Retina; Monkeys; Primates; Eye; Color Vision; Flicker Fusion; Luminosity; Vision/Brightness; Visual Sensitivity

24.
(U) Tech Objective - To diagnose and classify defective color vision in U.S. Army personnel and to investigate the physiological basis of defective color vision through work with infrahuman primates.

25. (U) Approach - The Farnsworth Munsell 100 hue test and Rayleigh match equations will be used to diagnose color vision anomalies in humans. Modifications of these tests will be used with monkeys and apes to compare primate vision with human vision. The anatomical organization of the visual system will be studied with light and electron optics. The electrophysiology of the system will be studied with micro- and macroelectrode recordings at the level of the retina and LGN.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Behavioral data: Mangabey and baboon behavioral data on effect of retinal area are acceptable and articles being prepared. Chimpanzee and gibbon studies making slow progress. Physiological data: Optical system for small spot ERG and receptive field studies now in final stages of fabrication. Hope to begin data collection on small spot ERG study soon. Program for processing ERG data by computer being written.

27. COMMUNICATIONS SECURITY	28.	29. DOD CODE	30. BUDGET CODE
☐ a. CRYPTO RELATED ☒ b. NOT CRYPTO RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPFF:	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1122)

B71P 08 085 (cont)

Detail Sheet # 1

(U) Progress:

Behavioral: Studies investigating the effect of retinal area (1, 2, 5, and 10°) on photopic spectral sensitivity have been completed on the mangabey and baboon. Definitive human control data for these studies are nearing completion. Similar studies on the chimpanzee and gibbon are making slow but satisfactory progress. Automation of the behavioral system to improve speed and accuracy of data collection is currently underway and fabrication of additional optical systems to investigate hue discrimination and Rayleigh match will be completed as soon as the spectral sensitivity studies are completed.

Physiological: Additional data have been added to the baboon ERG study and the manuscript is in preparation. Additional data were also collected on the mangabey lateral geniculate single unit study and final tabulations of the data are in progress. The development of necessary optics, electronics, etc., required for doing small spot ERG work is essentially complete and pilot data will soon begin. The small spot ERG investigations offer the exciting possibility of doing, for the first time, relatively precise retinal mapping with a physiological measure that could have application not only to understanding basic physiological mechanisms, but also clinically for the evaluation of various visual anomalies. Specifically, one of the purposes for developing this technique was to evaluate discrete experimentally produced laser-induced lesions.

Publications and/or Presentations:

Adams, C. K. and I. Behar. Stimulus change properties of the RT ready signal. Psychon. Sci. 6: 389-390, 1966; USAMRL Report No. 676, 1966 (DDC AD No. 645206).

Adams, C. K. and A. E. Jones. Spectral sensitivity of the Sooty mangabey. USAMRL Report No. 737, 1967.

Jones, A. E., C. K. Adams, and A. H. Bryan. The electroretinogram and primate spectral sensitivity. Presented (by Jones) at Psychonomic Society meeting, St. Louis, Mo., 27-29 Oct 1966.

B71F 08 085 (cont)

Detail Sheet # 2

Selected Bibliography:

Brindley, G. S. and G. Westheimer. The spatial properties of the human electroretinogram. J. Physiol. 179: 518-537, 1965.

DeValois, R. L., I. Abramov, and G. H. Jacobs. Analysis of response patterns of LGN cells. J. Opt. Soc. Amer. 56(7): 966-977, 1966.

DeValois, R. L., I. Abramov, and W. R. Mead. Single cell analysis of wavelength discrimination at the lateral geniculate nucleus in the macaque. J. Neurophysiol. 30: 415-433 1967.

Schrier, A. M. and D. S. Blough. Photopic spectral sensitivity of macaque monkeys. J. comp. physiol. Psychol. 62(3): 457-458, 1966.

Sidley, N. A. and H. G. Sperling. Photopic spectral sensitivity in the rhesus monkey. J. Opt. Soc. Amer. 57: 816-819, 1967.

Wiesel, T. N. and D. H. Hubel. Spatial and chromatic interactions in the lateral geniculate body of the rhesus monkey. J. Neurophysiol. 29: 1115-1156, 1966.

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6086	CSCRD-103
4. DATE OF RESUME	5. KIND OF RESUME / 6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67 (U) (U)	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61145011 3A014501B71P 08 086

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE:
(U) Vestibular Function and Disorientation

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
012900 Environmental Biology 002600 Biology 002700 Bionics	06 54	NA	OTHER | DA

16. PROCUR. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	33
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME: Headquarters	NAME: US Army Medical Res Laboratory
ADDRESS: US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS: Fort Knox, Ky. 40121
RESP. INDIV. Hedlund, LTC James L.	INVESTIGATORS PRINCIPAL ASSOCIATE: Wolfe, J. W., Ph. D. Brown, J. H., Ph. D. Marshall, CPT J. E.
TEL: 202-OX 66670	TEL: 502-43646 TYPE: DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Vestibular Apparatus; Acceleration/Body Rotation; Habituation; Adaptation/ Sensory Nystagmus; Sensation; Electrical Activity; Neurophysiology

24.

(U) Tech Objective - The objective is the thorough understanding of vestibular biophysics and physiology such that appropriate personnel selection, training, and equipment measures may be recommended prior to exposure of man to unusual acceleration environments.

25. (U) Approach - Psychophysiological and neurophysiological techniques are applied to the critical problems of vestibular function habituation, adaptation, central nervous system influence on labyrinthine functions, and end-organ biophysics. The specific techniques are electrical recording of eye movements; single cell assessment of electrical activity of specific areas of the brain, neuro-histology, and psychophysical judgments.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Research on the effects of nembutal, amphetamine, and lidocaine upon vestibular responses has been initiated. An important question to be answered is whether habituation is accrued in the absence of a nystagmic motor response. Work to clarify cerebellar and brainstem control of the vestibular system is continuing with a systematic series of implantations of both recording and stimulating electrodes in various sites as well as induction of lesions in the cerebellar tuber vermis. Results to date have been very encouraging.

Wolfe, J. W. Evidence for cerebellar control over habituation of vestibular nystagmus. Presented at the 38th Annual Meeting of the Eastern Psychological Association, Boston, Mass., 6-8 Apr 67.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. SECURITY CLASSIFICATION RELATED ☒ b. NOT CLASSIFIED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

34a. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPYA1	

DD FORM 1 AUG 66 1498A (Items 1 to 26 identical to NASA Form 1832)

B71P 08 086 (cont)

Detail Sheet # 1

(U) Progress:

Research to investigate the interaction of cerebello-vestibular structures has been initiated. Research on the effects of nembutal, amphetamine, and lidocaine upon vestibular responses is also in progress. An important question to be answered is whether habituation takes place in the absence of a nystagmic motor response. In addition, a systematic series of chronic recording and stimulating electrode implants is continuing with cats, in an attempt to delineate the neurological systems controlling habituation. To complement and hopefully verify this neurological data with anatomical evidence, histological material from cats with chronic lesions in the cerebellum is being sectioned for microscopic analysis of degeneration in the vestibular system.

Due to an almost complete lack of comparative data with reference to habituation and neurological structure, a program of comparative behavioral and physiological study has been initiated. Pilot data from kangaroo rat, and Rattus rattus indicate that rodents do not possess a "normal" nystagmic response to angular acceleration. It is hoped that further work with these animals as well as guinea pigs, cats, and primates will clarify knowledge of present physiological mechanisms.

In this regard, a restraint device has been developed which will permit electrophysiological recordings from infra-human primates while both in an unanesthetized condition and undergoing acceleration. Recording from unanesthetized monkeys trained in operant techniques will make it possible to compare electrophysiological responses with subjective illusions resulting from vestibular stimulation.

A new restraint device was also developed for cat to allow chronic electrode recordings to be taken without struggle artifacts. The cat work is continuing with the prime question related to the interaction of cerebellar and vestibular structures. This has included implanting of electrodes in the reticular formation, fastigial nuclei, vestibular nuclei, and centrum medianum.

An important question to be answered is what neurological role fatigue plays in disorientation and habituation. Since it has been

shown that the descending and medial vestibular nuclei are responsible (necessary) for the rapid eye movement (REM) phase of sleep, the interaction of fatigue with vestibular responses would appear to be a most meaningful neurophysiological question. This is further supported by the fact that one of the prime physiological changes after continued slow rotation is fatigue. The operation of fixed and rotary wing aircraft and the subsequent interaction of fatigue and vestibular stimulation, may be an important problem in the field. However, little behavioral and no physiological data are presently available on this subject. Nystagmic and electrophysiological studies in both cat and man are presently underway to investigate their relationships.

Publications and/or Presentations:

Crampton, G. H. Psychophysical and nystagmic thresholds for angular acceleration derived from 100 men. Presented at the Psychonomic Society meeting, St. Louis, Mo., 27-29 Oct 1966.

Wolfe, J. W. Evidence for cerebellar control over habituation of vestibular nystagmus. Presented at the 38th annual meeting of the Eastern Psychological Association, Boston, Mass., 6-8 Apr 1967.

Selected Bibliography:

Brodal, A. Anatomical observations on the vestibular nuclei, with special reference to their relations to the spinal cord and the cerebellum. Acta Oto-laryng. Su[illegible]. 192, 1964.

Carpenter, M. B. Lesions of the fastigial nuclei in the rhesus monkey. Amer. J. Anat. 104: 1-34, 1959.

Cohen, B., K. Goto, G. Shanzer, and A. H. Weiss. Eye movements induced by electric stimulation of the cerebellum in the alert cat. J. exp. Psychol. 63: 191-197, 1962.

Deura, S. and R. S. Snider. The interaction of various impulses in the cerebellum. J. Neurol, Sci. 1: 178-196, 1964.

B71P 08 086 (cont)

Detail Sheet # 3

Devito, R. V., A. Brusa, and A. Arduini. Cerebellar and vestibular influences on deitersian units. J. Neurophysiol. 19: 214-253, 1965.

DiGiorgio, A. M. and G. Pestellini. Inibizione acquista dei reflessi vestibolari: significato degli emisfere cerebrali e del cervelletto. Arch. fisiol. 48: 86-110, 1948.

Halstead, W., G. Yacorzynski, and F. Fearing. Further evidence of cerebellar influence in the habituation of after-nystagmus in pigeons. Amer. J. Physiol. 120: 350-355, 1937.

RESEARCH AND TECHNOLOGY RESUME

1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
		DA 0A 6101	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY RPT	SEC	7. DOWNGRADING	8. DEL. DATA LIMITATION	9. LEVEL OF RESUME
24 04 67	C. TERMINATED 20 12 66	U	U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61145011 3A014501B71P 08 087

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE:
(U) Chloroquine Retinopathy

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. ANT. COMPL. DATE	15. FUNDING AGENCY
012900 Physiology	08 66	08 67	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 66	0	0
		CURRENT FY 67	1	11

19a. GOVT LAB/INSTALLATION/ACTIVITY NAME:
ADDRESS: Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20 5
RESP. INDIV. Hedlund, LTC James . .
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20. PERFORMING ORGANIZATION NAME:
ADDRESS: US Army Medical Res Laboratory
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Bull, CPT R. W.
McClaskey, E. B.
TEL 502-43354 TYPE DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Pathophysiology; Vision; Chloroquine; Retinopathy; Primates; Malaria; Electroretinograph

23a.

(U) Tech Objective - To study chloroquine induced retinopathy in infrahuman primates attempting to correlate dose rate, total dosage, clinical testing and histopathological changes. To investigate the systemic changes induced by the various dosages.

(U) Approach - The mangabey Cercocebus torquatus atys will be used for this study. An appropriate number of animals will be divided into subgroups. Each subgroup will receive different doses of chloroquine. At regular intervals the animals will undergo fundoscopy, fundus photography, electroretinography, electroretinographic profiles, slit lamp examinations, and dark adaptation studies. Blood will be obtained for spectrophotometric quantitative determinations of chloroquine concentrations in serum and erythrocytes, complete blood counts, serum electrolytes and serum enzymes. Individual animals will be selected at judicious time intervals for unilateral enucleation. The enucleated animal will be taken off chloroquine and at a later date the other eye will be taken. By this method we hope to elucidate the reversibility or irreversibility of a retinal lesion at a known dose level. Post-mortem examinations will be done on all animals.

(U) Progress (20 Dec 66 - 31 Mar 67) - Pilot work was suspended due to lack of adequate personnel capability due to departure of involved personnel.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. CLASSIFIED ☐ b. NOT CLASSIFIED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPY+1	

DD FORM 1 AUG 64 1498A (Items 1 to 26 identical to NASA Form 1332)

B71P 08 087 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Carr, R. E., P. Gouras, and R. D. Gunkel. Chloroquine retinopathy. Arch. Ophthal. 75: 171, 1966.

Henkind, P., R. E. Carr, and I. M. Siegel. Early chloroquine retinopathy: clinical and functional findings. Arch. Ophthal. 71: 157, 1964.

Jones, A. E., Martha C. Polson and R. L. DeValois. Mangabey x and b wave electroretinogram components: their dark-adapted luminosity functions. Science, 146: 1486-1487, 1964.

Merwin, C. G. and R. K. Winkelmann. Anti-malarial drugs in the therapy of lupus erythematosus. Mayo Clin. Proc. 37: 253, 1959.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6078	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
24 07 67	D. CHANGE 01 07 67	U (RPT) U (RSR)	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
61145011 3A014501B71P 02 020	61145011 3A014501B71P 10 021

11. TITLE:

(U) The Pathology of Animal Diseases of Military Significance

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology 001700 Animal Husbandry	07 61	NA	OTHER, DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	.NA	PRIOR FY 67	1	24
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION/ACTIVITY

NAME/ADDRESS: Headquarters
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REPR. INDIV. Rose, LTC L. R.

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20. PERFORMING ORGANIZATION

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Dedrick, CPT R. S.
Bull, CPT R. W.

TEL 502-43937 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Animals; Animals, Laboratory; Diseases of Animals; Parasitic Diseases; Primates; Virus Diseases

24.

(U) Tech Objective - To identify, characterize and treat the sporadically occurring diseases encountered in the laboratory animals utilized, with particular attention to those diseases that may be communicable to man.

(U) Approach - The animal colonies of the laboratory (primate, cats, dogs, rabbits, rats, mice) will be continually scrutinized for the presence of disease agents or processes. When recognized as such, the pathogenesis of the disease state will be investigated.

(U) Progress (1 Apr 67 - 30 Jun 67) - The use, in newly acquired cats, of endogenous plasma from our feline colony residences has reduced the 50% panleukopenia mortality in these animals to nil. Presently, evaluation of the efficiency and economics of such a prophylactic procedure is being compared to the commercially available panleukopenia antiserum. The continuous temperature monitoring procedures for pyrogen testing in rabbits is ready for use by the Blood Transfusion Division, USAMRL. Our cytogenic techniques for miotic chromosomes are standardized and we are developing tissue culture and direct cytological procedures for miotic chromosome configurations. The progressive bacteriology capabilities of the clinical laboratory, coupled with animal inoculation, has enabled the isolation of a small pleomorphic organism associated with a granulomatous hepatitis of rabbits. Efforts are continuing to identify the organism. All animal handlers have completed a continuing education course in laboratory animal care.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ CLASSIFIED RELATED ☒ NOT CLASSIFIED RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPFF:	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1739)

B71P 10 021 (cont)

Detail Sheet # 1

(U) Progress:

Feline panleukopenia in previous years has caused up to 50% mortality in newly arrived, random source, nonconditioned cats. This year we have carefully evaluated the efficacy of endogenous serum in protecting against the disease. Of the 81 cats included in this study, 37 received endogenous serum, 6 cats received commercially available serum and 38 received no serum. There were 14 deaths in the latter group which were diagnosed as panleukopenia on the basis of clinical signs, hematologic values and necropsy findings. Work is continuing in this area to collect more data and a publication is anticipated.

The decreased fecundity in the hairless mouse colony last year was partially due to improper husbandry procedures which have been corrected; however, it stimulated our interest in the genetics of these mice. As a result, we have adapted a squash preparation for male miotic chromosomes to our laboratory and are currently developing our techniques for tissue culture of somatic cells for evaluation of mitotic figures. Our early results would indicate some abnormality in the end to end association of the X and Y chromosomes in a number of miotic metaphase figures in hairless males. Further work is needed to substantiate or refute this observation.

We are continuing our efforts in the attempt to determine the pathogenesis of the granulomatous hepatitis noted in newly received rabbits. Current findings would indicate a small intracytoplasmic coccobacillus as the etiologic agent. This organism may be seen occasionally in hematoxylin and eosin stained sections. When visible in gram stained tissue sections, the organism assumes a gram positive to purplish appearance. It is most apparent when stained with a modified Machiavello's method.

A sporadic disease has been noted recently in young mice in our white mouse colony. Clinically one sees swollen joints which eventually progress to auto-amputation of an extremity as is present in mouse pox or infection with Streptobacillus moniliformis. Histologic preparations tend to rule out the viral etiology and attempts are being made to culture a causative agent. Pathogenic streptococci and staphylococci

have been isolated from internal organs and hearts blood of those animals moribund and dead.

Several new techniques and capabilities have been added to our clinical pathology section. The most important of these would be a functioning bacteriology ability. This has greatly improved our ability to monitor the health status of the animal colony.

Publications and/or Presentations:

Ross, M. A. and W. G. Sheldon. Hematological data on the Sooty mangabey monkey (Gercocebus torquates atys). USAMRL Report No. 679, 1966 (DDC AD No. 645448).

Sheldon, W. G. Pulmonary blastomycosis in a cat. USAMRL Report No. 690, 1966 (DDC AD No. 643609); Lab. Animal Care, 16: 280, 1966.

Sheldon, W. G. Psorergatic mange in the Sooty mangabey (Cercocebus torquates atys) monkey. USAMRL Report No. 691, 1966 (DDC AD No. 643608); Lab. Animal Care, 16: 276, 1966.

Sheldon, W. G. Fibrous gingival hyperplasia of a mustache guenon monkey (Cercopithecus cephus). USAMRL Report No. 736, 1967; Lab. Animal Care, 17: 140, 1967.

Sheldon, W. G. and M. A. Ross. A generalized herpes virus infection in owl monkeys. USAMRL Report No. 670, 1966 (DDC AD No. 645081).

Treviño, G. S. Pathologic study of a case of canine blastomycosis with ocular involvement. USAMRL Report No. 725, 1967 (DDC AD No. 649984); Path. Vet. 3: 652, 1966.

Selected Bibliography:

Krise, G. M., Jr. and N. Wald. Normal blood picture of the Macaca mulatta monkey. J. Appl. Physiol. 12: 482, 1958.

B71P 10 021 (cont)

Detail Sheet # 3

Gardner, M. V. The blood picture of normal laboratory animals. A review of the literature, 1936-1949. J. Franklin Institute, 244: 155, 1947.

Hunt, R. D. and L. V. Melendez. Spontaneous herpes-T infection in the owl monkey (Aotus trivirgatus). Path. Vet. 3: 1-26, 1966.

Melnick, J. L., M. Midulla, J. Wimberly, J. G. Barrera-Ora and B. M. Levy. A new member of the herpes virus group isolated from South American marmosets. J. Immunol. 92: 596-601, 1964.

Rivers, T. M. Viral and Rickettsial Infections of Man. Philadelphia, Pennsylvania: J. P. Lippincott, 2nd Ed., 1952.

Easton, K. L. Cutaneous North American blastomycosis in a Siamese cat. Can. Vet. J. 2: 350-351, 1961.

Menges, R. W. Blastomyces in animals. Vet. Med. 55: 45-54, 1960.

Ohno, S., W. D. Kaplan and R. Kinosita. On the end-to-end association of the X and Y chromosomes of Mus musculus. Exper. Cell Res. 18: 282-290, 1959.

Van Leeuwenhoek, Antonie. Virus pneumonia (sniffling disease) in laboratory rats and in wild rats due to an agent probability related to grey lung virus of mice. J. Microbiol. Serol. 23: 172-183, 1957.

Nelson, John B. Infectious catarrh of the albino rat. J. Exper. Med. 72: 655-662, 1940.

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6080	CSCRD-103
4. DATE OF RESUME: 24 07 67	5. KIND OF RESUME: C. TERMINATED 01 07 67	6. SECURITY: U U	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61145011 3A014501B71P 10 023

10b. PRIOR NUMBER CODE: NO CHANGE

11. TITLE:
(U) Immunology, Toxicology and Hematochemistry of Venoms

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002300 Biochemistry	12 63	NA	OTHER , DA

16. PR. CURR. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In Thousands)
C. In-House	NA	PRIOR FY 67	2	51
		CURRENT FY 68	0	0

19. GOVT LAB/INSTALLATION/ACTIVITY
NAME:
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TEL: 202-OX 65237

20. PERFORMING ORGANIZATION
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INVESTIGATOR(S) PRINCIPAL ASSOCIATE: Kocholaty, W. F., Ph. D.
Ledford, M. E.
Billinge, T. A.
TEL: 502-44350 TYPE: DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS:
Crotalus atrox; Lethal Protein; Proteolytic Activity

24.

(U) Tech Objective - To isolate, purify and identify the lethal protein constituents of Crotalus atrox venom.

(U) Approach - The venom, either in an untreated form or after reaction with diisopropylfluorophosphate, has been resolved by column chromatography on DEAE-cellulose. The biologic activities of the separated proteins were then determined.

(U) Progress (1 Apr 67 - 30 Jun 67) - Lethal proteins with LD_{50} values as toxic as 7 µg per 20-25 g mouse were found to be mixtures of probably two or more proteins. On molecular sieve filtration, these proteins behaved as comparatively large molecules (greater than 300,000). However, preliminary evidence from an ultracentrifugation run indicated a much smaller molecule being present. The slides developed after immunoelectrophoresis suggested that, to some extent, a large molecule was breaking down to smaller sub-units, which could explain the disparity between the elution results with either Sephadex G-150, Biogel P-300 or Sepharose 4 B, and with the rate of sedimentation in the ultracentrifuge. A residual amount of proteolytic activity of low specific activity has remained associated with the lethal protein, despite the relatively high degree of purification with respect to other enzymatic activities. Work is in progress in an effort to establish if the lethal protein is this proteinase whose unique specificity is poorly suited to the usual proteolytic substrates--casein, collagen dyes and hemoglobin.

25. COMMUNICATIONS SECURITY	26.	27. OSD CODE	28. SUBSET CODE
☐ a. CRYPTO RELATED ☒ b. NOT CRYPTO RELATED		BR	1

29. MISSION OBJECTIVE	30. PARTICIPATION
NA	NA

31. REQUESTING AGENCY	32. SPECIAL EQUIPMENT

33. EST. FUNDS (In Thousands)	34.
CY 68	

DD FORM 1 AUG 66 1498A (Items 1 to 35 identical to NASA Form 1121)

B71P 10 023 (cont)

Detail Sheet # 1

(U) Progress:

Column chromatography on fibrous DEAE-cellulose in TRIS-HCl-buffer pH 7.2 with an altered elution gradient permitted the fractionation of the major portion of the lethal protein of C. atrox from other biologically active material. Limited degrees of resolution of the lethal protein were found to occur using molecular sieve filtration (sephadex, sepharose, biogel) or ammonium sulfate fractionation. Inhibition of esterolytic activity with DFP did not lead to the isolation of a more toxic lethal protein, although contaminant biologic activity other than toxicity was minimized. A homogeneous lethal protein was not achieved. There is no evidence to date to suggest that the lethal protein corresponds to any degradative enzyme to be present in C. atrox venom. A USAMRL report, "Further observations on the properties of the lethal protein in Crotalus atrox venom," has been written and is presently undergoing minor revisions.

Publications and/or Presentations:

Ashley, B. D. and P. M. Burchfield. Maintaining a snake colony for venom collection. USAMRL Report No. 696, 1966 (DDC AD No. 647149).

Ashley, B. D. and P. M. Burchfield. Biology of snakes. Lecture given to the Meeting of the 4th District Education Association Science Teachers, Elizabethtown, Ky., 14 Oct 1966.

Ashley, B. D. and P. M. Burchfield. Current recommendations for first aid and medical care of victims of snake envenomation and prevention of bites. Lecture given to the Hardin-LaRue County Medical Society Meeting, Elizabethtown, Ky., 5 Jan 1967.

Ashley, B. D. and D. P. Thompson. Snakes and snakebite. Lecture given to the Pre-Medical Fraternity Meeting, University of Louisville, Louisville, Ky., 20 Mar 1967.

Ashley, B. D., P. M. Burchfield and D. P. Thompson. Venomous snakes and snakebites in Kentucky. Lecture given to the Ky. State Association of Medical Assistants, Park City, Ky., 13 May 1967.

B71P 10 023 (cont)

Detail Sheet # 2

Bobbitt, J. L. and D. E. Reed. Differentiation between proteolytic and TAME esterolytic activity in Crotalus atrox venom. USAMRL Report No. 712, 1966 (DDC AD No. 647148); presented (by Reed) at Southeastern Regional Meeting of the American Chemical Society, Louisville, Ky., 27-29 Oct 1966.

Burchfield, P. M. Instruction of personnel departing for Vietnam. Lecture given to the POR/POM Course, 4th Battalion (Mechanized), 54th Infantry, Fort Knox, Ky., Nov 1966.

Reed, D. E. The resolution of enzymatic activities in Crotalus atrox venom by chromatography on DEAE-cellulose. USAMRL Report No. 705, 1966 (DDC AD No. 645904).

Selected Bibliography:

Pfleiderer, G. and G. Sumyk. Separation of rattlesnake venom proteinases by cellulose ion-exchange chromatography. Biochim. Biophys. Acta, 51: 482, 1961.

Peterson, E. A. and H. A. Sober. Variable gradient device for chromatography. Anal. Chem. 31: 857, 1959.

Reed, L. J. and H. Muench. A simple method of estimating fifty per cent end points. Amer. J. Hyg. 21: 493, 1938.

Project No. 3A014501B71R	Research in Biomedical Sciences
Task No. 01	Surgery
Work Unit No. 100	Acute and Chronic Effects of Laser Radiation on Mammalian Tissues
Work Unit No. 101	Ocular Effects of Laser Radiation
Work Unit No. 102	Effects of Laser Radiation on Immune Mechanisms
Work Unit No. 103	Cutaneous Burns Induced by Laser Radiation
Work Unit No. 104	Effects of Laser Radiation on the Mammalian Hematopoietic System
Work Unit No. 105	Effects of Laser Radiation on Active Transport in Living Membranes
Work Unit No. 275	Laser Effects on Performance
Work Unit No. 276	Instrumentation Design

Investigators, FY 1967:

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#101	A. H. Bryan, Captain, MC G. H. Herbener, M.S.
#102	A. J. Luzzio, Ph.D.

#103	A. S. Brownell, Ph.D. W. H. Parr, Ph.D. R. S. Fisher, Captain, MC D. K. Hysell, Captain, VC R. S. Dedrick, Captain, VC
#104	R. S. Fisher, Captain, MC W. H. Parr, Ph.D. R. S. Dedrick, Captain, VC
#105	T. L. Davis, Captain, MC
#275	S. H. Revusky, Ph.D.
#276	J. C. Rosenbaum, Jr., M.S. J. F. Medley

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6088	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY RPT / SEC	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U / U	NA	NL	A, WORK UNIT

10a. CURRENT NUMBER/CODE	10b PRIOR NUMBER/CODE
61145011 3A014501B71R 01 100	NO CHANGE

11. TITLE:
(U) Acute and Chronic Effects of Laser Radiation on Mammalian Tissues

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	07 63	NA	OTHER | DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST.	d. PROFESSIONAL MAN-YEARS	e. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	3	66
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315 RESP. INDIV. Rose, LTC L. R. TEL. 202-OX 66082	NAME US Army Medical Res Laboratory ADDRESS Fort Knox, Ky. 40121 INVESTIGATORS PRINCIPAL Parr, W. H., Ph.D. ASSOCIATE Peacock, CPT G. R. Leibowitz, CPT H. M. TEL 502-45149 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS Laser, Animal Studies; Laser Injury, Biological; Acute; Chronic; Radiation, Thermal; Retina; Eye; Eye Burns; Eye Injuries; Hazard

24.

(U) Tech Objective - To appraise effects of laser irradiation on various tissues and organs and biological materials with emphasis on acute and long-term effects.

(U) Approach - Changes occurring in rat corneal epithelial cells due to ruby and CO_2 laser irradiation will be investigated and correlated with absorbed dose. Effects of high doses of ruby, Nd, and CO_2 laser radiation on animal eyes will be studied and related to whole body effects. Studies of modes of interaction of laser radiation with bio-materials will be conducted.

(U) Progress (1 Apr 67 - 30 Jun 67) - Previous experiments in which aberrant cells were produced in the cornea of rats by ruby laser radiation have been repeated. Other preliminary studies indicate that the number of aberrant cells produced using a constant power density will depend on the pulse length of the beam. A laboratory report of kidney damage as a consequence of laser irradiation and the subsequent effects in the body as a whole is being prepared. A model, based on surface temperature increases, has been formulated and compared with experimental laser injury data reported in the literature and gathered in this laboratory.

Peacock, G. R. Surface temperature as a parameter in estimating laser injury thresholds. USAMRL Rep. No. 733, 1967.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ CONTAINS RELATED ☒ NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REGULATING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CY+1	

DD FORM 1 AUG 66 1498 A (Items 1 to 36 identical to NASA Form 1732)

B71R 01 100 (cont)

Detail Sheet # 1

(U) Progress:

Laser irradiation of renal and ocular structures in animals revealed the following: a) Biweekly lasing (6943 Å) at 12.5 j/cm^2 and 6.0 j/cm^2 of translocated kidneys in rats resulted in gross damage to overlying skin and kidneys at the higher energy level and in microscopic damage at the lower level. A decrease in urinary output with proteinuria and loss of body weight was also noted. b) Studies using a small number of animals indicate that atypical cells may still persist in the corneal epithelium of the rat 180 days after exposure to ruby laser radiation (4 j/cm^2). On the basis of comparison with CO_2 laser effects, the production of atypical cells are thought to be a thermal effect. Preliminary threshold values obtained for the production of these aberrant cells are between 0.5 and 1.0 j/cm^2 for a 3 msec pulse of ruby laser radiation and approximately the same for a 40 msec pulse of CO_2 laser radiation.

Gross in vivo evaluation of rat eyes immediately after exposure to 4 j, 8 j and 12 j/cm^2, showed hemorrhages and bubbles in the anterior chamber and a steamy opacity of the cornea which appeared to be dose dependent. After 30 days, nearly complete recovery from ocular inflammation had occurred at the lower dose level while at the higher levels massive hemorrhages were seen in the anterior chamber. In pigmented rabbit eyes, energy densities as low as 0.1 j/cm^2 (normal pulse, collimated, 6943 Å) incident on the cornea caused retinal destruction and vitreous hemorrhage.

Publications and/or Presentations:

Bull, R. W. Ruby laser's biological effect on the kidney and skin of hooded Long-Evans rats. Presented at the Gordon Research Conference, Lasers in Medicine and Biology, Andover, N. H., 19-23 Jun 1967.

Fine, S., E. Klein, W. H. Parr, B. Fine, R. S. Fisher and G.R. Peacock. Hazard studies with laser radiation. Presented (by S. Fine) at the Third DOD Laser Conference on Laser Technology, Pensacola, Fla., 18 Apr 1967.

B71R 01 100 (cont)

Detail Sheet # 2

Fisher, R. S. and W. H. Parr. The fundamental concepts of laser radiation and the bi logical effects of laser radiation. Presented (by Fisher) at the Health Physics Society - Midwest Chapter's Joint Meeting, Cumberland Falls, Ky., 9-11 Sep 1966.

Jones, A. E. and A. J. McCartney. Ruby laser effects on the monkey eye. Invest. Ophth. 5(5): 474-483, 1966.

Leibowitz, H. M. Medical aspects of incapacitation. Presented at the US Army Conference on Laser Eye Protection, Natick, Mass., 24 May 1967.

Parr, W. H. and R. S. Fisher. Aberrant corneal epithelial cells produced by ruby laser irradiation. USAMRL Report No. 698, 1966 (DDC AD No. 645452); presented (by Fisher) at the Northeast Electronics Research and Engineering Meeting, Boston, Mass., 2-4 Nov 1966.

Parr, W. H. and G. R. Peacock. Corneal damage from laser radiation. Presented (by Parr) at the Gordon Research Conference, Lasers in Medicine and Biology, Andover, N. H., 19-23 Jun 1967.

Parr, W. H., G. R. Peacock and R. S. Fisher. Laser effects on the corneal epithelium. Presented (by Parr) at the IEEE Ninth Annual Symposium on Electron, Ion, and Laser Beam Technology, Berkeley, Calif., 9-11 May 1967; presented (by Parr) at the US Atomic Energy Test Site, Mercury, Nev., 12 May 1967.

Peacock, G. R. Laser hazards and safety. Presented at the Junior Science and Humanities Symposium, Fort Knox, Ky., 1 Apr 1967.

Peacock, G. R. Medical aspects of incapacitation. Presented at the US Army Conference on Laser Eye Protection, Natick, Mass., 24 May 1967.

Peacock, G. R. Surface temperature model for laser injury. Presented at the Gordon Research Conference, Lasers in Medicine and Biology, Andover, N. H., 19-23 Jun 1967.

B71R 01 100 (cont)

Detail Sheet # 3

Peacock, G. R. Surface temperature as a parameter in estimating laser injury thresholds. USAMRL Report No. 733, 1967.

Selected Bibliography:

Proceedings of the First Annual Conference on Biological Effects of Laser Radiation. Fed. Proc. 24: Suppl. 14(2), Jan-Feb 1965.

Staff of Wilmer Institute. Studies on the physiology, biochemistry, and cytopathology of the cornea in relation to injury by mustard gas and allied toxic agents. Bull. Johns Hopkins Hosp. 82: 51, 1945.

Ransom, R. G. The influence of ionizing radiation on mitosis in the corneal epithelium of the rat. USAMRL Report No. 110, 1953 (DDC AD No. 20875).

Gay, H. and B. P. Kaufman. The corneal epithelium as a source of mammalian somatic mitoses. Stain Tech. 25: 209, 1950.

NEREM Record, Boston, Mass., Nov 1966.

Laor, Y., C. Simpson, E. Klein and S. Fine. The pathology of laser irradiation of the skin and body wall of the mouse. Amer. J. Path. 47(4), Oct 1965.

RESEARCH AND TECHNOLOGY RESUME					
			DA 0A 6093	CSCRD-103	
4. DATE OF RESUME: 14 09 66	5. KIND OF RESUME: C. TERMINATED 01 07 66	6. SECURITY: U U	7. REMARKS: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A. WORK UNIT
10a. CURRENT NUMBER/CODE: 61145011 3A014501B71R 01 101			10b. PRIOR NUMBER-CODE: NO CHANGE		
11. TITLE: (U) Ocular Effects of Laser Radiation					
12. SCIENTIFIC OR TECH. AREA: 002600 Biology; 009600 Masers and Lasers			13. START DATE: 07 65	14. CRIT. COMPL. DATE: NA	15. FUNDING AGENCY: OTHER | DA
16. PROCURE. METHOD: C. In-House	17. CONTRACT/GRANT: a. NUMBER b. TYPE: NA c. DATE d. AMOUNT		18. RESOURCES EST.: PRIOR FY 66; CURRENT FY 67	a. PROFESSIONAL MAN-YEARS: 1; 0	b. FUNDS (In thousands): 16; 0
19. GOV'T LAB/INSTALLATION/ACTIVITY: NAME; ADDRESS: Headquarters, US Army Medical Res & Dev Command, Washington, D. C. 20315; RESP. INDIV.: Rose, LTC L. R.; TEL.: 202-OX 66082			20. PERFORMING ORGANIZATION: NAME; ADDRESS: US Army Medical Res Laboratory, Fort Knox, Ky. 40121; INVESTIGATORS PRINCIPAL ASSOCIATE: Bryan, CPT A. H., Herbener, G. S.; TEL: 502-43354 TYPE: DA		
21. TECHNOLOGY UTILIZATION: NA			22. COORDINATION: NA		
23. KEYWORDS: Laser; Retina; Primates; Eye; Neurophysiology; Visual Sensitivity; Vision/Brightness					

24.

(U) Tech Objective - To investigate the effects on retinal structure, and visual electrophysiology, of varying the retinal area, the energy density, and power of laser pulses on the primate retina.

25. (U) Approach - An optical path using an integrating sphere to achieve pulse homogeneity, and appropriate field stops has been designed to yield retinal laser doses of rigidly controlled energy density and area. Pulse forming networks to control pulse duration are being installed. Pre- and post-exposure ocular examinations including fundus photographs and pre- and post-exposure ERG are carried out on each animal. Histological analysis of retina and brain are carried out on each exposed animal.

26. (U) Progress (1 Jul 65 - 30 Jun 67) - This work unit was terminated on 14 Sep 66 because of the transfer of the principal investigator.

27. COMMUNICATIONS SECURITY: ☐ a. CLASSIFIED ☐ b. UNCLASSIFIED	28.	29. DOD CODE: BR	30. BUDGET CODE: 1
31. MISSION OBJECTIVE: NA		32. PARTICIPATION: NA	
33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT		
35. EST. FUNDS (In thousands) CY 67	36.		

DD FORM 1498A (Items 1 to 36 identical to NASA Form 1132)

B71R 01 101 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Jones, A. E. and A. J. McCartney. Ruby laser effects on the monkey eye. Invest. Ophth. 5. 474, 1966.

Ham, W. T., H. Weisinger, F. H. Schmidt R. C. Williams, R. S. Ruffin, M. C. Schaffer and D. Guerry, III. Flash burns in the rabbit retina. Amer. J. Ophth. 46: 700, 1958.

Jacobson, J. H., Blossom Cooper and H. W. Najac. Effects of thermal energy on retinal function. Technical Documentary Report No. AMRL-TDR-62-96-1962.

Foulds, W. E. Experimental retinal detachment. Tr. Ophth. Soc. U. Kingdom, 83: 153, 1963.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6075	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
61145011 3A014501B71R 01 102	NO CHANGE

11. TITLE:
(U) Effects of Laser Radiation on Immune Mechanisms

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology; 009600 Masers and Lasers	10 59	NA	OTHER , DA

16. PROCU. METHOD	17. CONTRACT/GRANT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	a. NUMBER / c. TYPE NA / b. DATE / d. AMOUNT	PRIOR FY 67	1	23
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME / ADDRESS: Headquarters, US Army Medical Res & Dev Command, Washington, D. C. 20315	NAME / ADDRESS: US Army Medical Res Laboratory, Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL: Luzzio, A. J., Ph. D.
	ASSOCIATE: Leibowitz, CPT H. M.
TEL. 202-OX 66082	TEL. 502-46645 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS
Laser; Antibody; Antigen; Immunity

24.

(U) Tech Objective - To determine the effects of laser energy on immune mechanisms, thus evaluating laser radiation as a possible deterrent of immunity.

(U) Approach - This research is divided into two phases: 1) The study of the direct effect of laser energy on blood serum proteins. Electrophoresis analyses will ascertain whether blood proteins will maintain their original electrophoretic and molecular identity after laser exposure in vitro. 2) The study of the effects of lasing the spleen on the primary and secondary antibody responses. Serum separated from blood taken from rabbits at periodic intervals after antigen injection will be measured quantitatively for antibody. Antibody produced from laser exposed and non-exposed controls can then be plotted against time.

(U) Progress (1 Apr 67 - 30 Jun 67) - Several groups of intact rabbits immunized with bovine serum albumin (BSA) were exposed to laser energies ranging from 100 to 800 joules in the splenic area. Thus far, the results are inconclusive; however, definite trends are apparent which suggest that the primary and secondary immune responses are enhanced when the antigen is injected one hour after laser treatment. No gross skin lesions were observed at the target area other than a very slight erythema. Total serum protein was not affected. The animals have been sacrificed and microscopic sections of spleens will be examined for histological study. The above experiments are currently being repeated for confirmation of the data.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC OR COMSEC RELATED / b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands) CFY+1	36.

DD FORM 1 Aug 64 1498A (Items 1 to 36 identical to NASA Form 1122)

B71R 01 102 (cont)

Detail Sheet # 1

(U) Progress:

Measurements on a number of rabbits showed that the spleen of a rabbit could be located accurately with the xiphoid process as a reference point. Several groups of rabbits were exposed to various levels of ruby laser radiation through the intact skin at the splenic site determined by the method briefly described above. One hour after exposure, each animal was injected subcutaneously with bovine serum albumin (BSA). Unlased rabbits were also injected and served as a control group. All animals were bled at periodic intervals before and after exposure and serum anti-BSA levels were determined by the quantitative precipitin method. Forty days after initial exposure and injection, a second laser exposure was given each animal at the same site followed by a second BSA injection one hour later. Anti-BSA concentrations were determined for each animal at periodic intervals following radiation.

Thus far, the results show that no significant differences occurred in the primary and secondary immune responses of rabbits exposed to 100-200 joules of ruby laser radiation. Anti-BSA appeared to increase in the primary immune response after 400 joules of radiation and a greater increase in anti-BSA occurred during the secondary response after an additional 400 joules, or a total of 800 joules, had been delivered.

The laser injury to the rabbits was restricted to a circular area 1 cm in diameter and was marked by a slight erythema with no swelling of the skin. At autopsy, 60 days after exposure, gross and microscopic pathology showed no evidence of injury to the spleen or surrounding organs, nor any suggestions of repair.

At this time, due to wide variations in immune responses between individual animals, a statistical analysis of the data does not support the final conclusion that laser radiation of the spleen enhances the immune response. However, since trend effects are apparent, these experiments are being repeated, with some modifications, to reduce biological variations so that a valid statistical analysis can be made.

B71R 01 102 (cont)

Detail Sheet # 2

Publications and/or Presentations:

None.

Selected Bibliography:

Kabat, E. A. and M. M. Mayer. Experimental Immunochemistry. Springfield, Ill.: Charles C. Thomas, 1948.

Litwin, M. S. and K. M. Earle (eds.). First Annual Conference on Biologic Effects of Laser Radiation. Fed. Proc. Suppl. No. 14, 1965.

RESEARCH AND TECHNOLOGY RESUME

Field	Value
2. Govt Accession	
3. Agency Accession	DA 0A 6103
Report Control Symbol	CSCRD-103
4. Date of Resume	01 07 67
5. Kind of Resume	D. CHANGE 24 04 67
6. Security	U U
7. Regrading	NA
8. Release Limitation	NL
9. Level of Resume	A. WORK UNIT
10a. Current Number/Code	61145011 3A014501B71R 01 103
10b. Prior Number/Code	NO CHANGE
11. Title	(U) Cutaneous Burns Induced by Laser Radiation
12. Scientific or Tech. Area	002600 Biology; 009600 Masers and Lasers
13. Start Date	07 66
14. Crit. Compl. Date	NA
15. Funding Agency	OTHER , DA
16. Procur. Method	C. In-House
17. Contract/Grant	b. Number: NA; c. Type:
18. Resources Est.	Prior FY 67: Professional Man Years 1, Funds (In thousands) 31; Current FY 68
19. Gov't Lab/Installation/Activity	Headquarters, US Army Medical Res & Dev Command, Washington, D. C. 20315; Resp. Indiv.: Rose, LTC L. R.; Tel. 202-OX 66082
20. Performing Organization	US Army Medical Res Laboratory, Fort Knox, Ky. 40121; Investigators: Principal Brownell, A. S., Ph. D.; Associate Parr, W. H., Ph. D.; Tel. 502-45149; Type DA
21. Technology Utilization	NA
22. Coordination	NA
23. Keywords	Laser; Thermal Burns; Skin; Radiation Biology; Radiation

24. (U) Tech Objective - To investigate the potential of high intensity laser radiation to induce cutaneous and deeper burns as a function of power density, time of exposure and frequency.

25. (U) Approach - The initial approach will be to quantitatively relate the extent of thermal damage in porcine skin to power density and time of exposure to 10.6 micron laser radiation. The severity of the lesions will be varied from threshold injury to extensive destruction of the skin and underlying tissues. Radiation parameters will be varied over the range limited by the CO_2 laser available. Subsequent studies will be extended to other wavelengths of interest.

(U) Progress (1 Apr 67 - 30 Jun 67) - The dose-response relationship for threshold burns induced by 10.6 micron laser radiation has been determined for power densities within the range of 1 to 8 watts/cm^2 and exposure times 0.4 to 18 sec. In the range from 1.5 to 8 watts/cm^2 the data fit the equation $H = 4.13t - .067$ where H = incident power density (watts/cm^2) and t = median effective exposure time (sec). Limited data suggest that below 1.5 watts/cm^2 this relationship changes.

Brownell, A. S., W. H. Parr, D. K. Hysell, and R. S. Dedrick. Threshold lesions induced in porcine skin by CO_2 laser radiation. USAMRL Rep. No. 73?, 1967.

Field	Value
27. Communications Security	Not Related
29. OSD Code	BR
30. Budget Code	1
31. Mission Objective	NA
32. Participation	NA
33. Requesting Agency	
34. Special Equipment	
35. Est. Funds (In thousands)	CFY+1

DD FORM 1 AUG 64 1498A

B71R 01 103 (cont)

Detail Sheet # 1

(U) Progress:

The dose-response relationship for cutaneous burns, ranging from minimally detectable erythema to partial tissue coagulation, has been determined for a limited range of CO_2 laser radiation power densities and exposure times. The data to date indicate that the dose-response relationship for all measured degrees of injury within this power density range (1 to 8 watts) may reasonably be described by simple power functions. However, limited data suggest that these relationships may change outside this power density range. The best mathematical fit of the data will be determined after experiments at high and lower power densities. Numerous biopsies are now being processed and analyzed by histochemical methods to evaluate depth of tissue change as a function of power density and exposure time.

Publications and/or Presentations:

Brownell, A. S., W. H. Parr, D. K. Hysell, and R. S. Dedrick. Threshold lesions induced in porcine skin by CO_2 laser radiation. USAMRL Report No. 732, 1967; presented (by Brownell) at the Gordon Conference on Lasers in Medicine and Biology, Andover, N. H., 19 Jun 1967.

Selected Bibliography:

Henriques, F. C., Jr. and A. R. Moritz. Studies of thermal injury. I. The conduction of heat to and through skin and the temperatures attained therein. A theoretical and an experimental investigation. Amer. J. Pathol. 23: 531, 1947.

Moritz, A. R. and F. C. Henriques, Jr. Studies of thermal injury. II. The relative importance of time and surface temperature in the causation of cutaneous burns. Amer. J. Pathol. 23: 695, 1947.

Moritz, A. R. Studies of thermal injury. III. The pathology and pathogenesis of cutaneous burns. An experimental study. Amer. J. Pathol. 23: 915, 1947.

B71R 01 103 (cont)

Detail Sheet # 2

Perkins, J. B., H. E. Pearse, and H. D. Kingsley. Studies on flash burns: the relation of the time and intensity of applied thermal energy to the severity of burns. University of Rochester Atomic Energy Project Report UR-217, 1952.

Lyon, J. L., T. P. David and H. E. Pearse. Studies of flash burns. The relation of thermal energy applied and exposure time to burn severity. University of Rochester Atomic Energy Report UR-394, 1955.

Davies, J. M. The effect of intense radiation on animal skin. A comparison of calculated and observed burns. Quartermaster Research and Engineering Command Report T-24, 1959 (DDC AD No. 456794).

Derksen, W. L., J. Bracciavanti and G. Mixter, Jr. Burns to skin by millisecond light pulses. NAVAPLSCIENLAB Project 9400-12, Report 1, 1964.

Fine, S., W. P. Hanson, G. R. Peacock, E. Klein and Y. Laor. Biophysical studies with the CO_2 laser. NEREM Record, p. 166, 1966.

Helevig, E. B., W. A. Jones, J. R. Hayes and E. H. Zeitler. Anatomic and histochemical changes in skin after laser irradiation. First Annual Conference on Biological Effects of Laser Radiation, Fed. Amer. Soc. Exper. Biol. Proc. Suppl. 14, 1965.

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
4. DATE OF RESUME: 01 07 67	5. KIND OF SUMMARY: C. TERMINATED 24 04 67	6. SECURITY: U U (RPT WRK)	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A, WORK UNIT
10a. CURRENT NUMBER/CODE: 61145011 3A014501B71R 01 104		10b. PRIOR NUMBER/CODE: NO CHANGE			

11. TITLE
(U) Effects of Laser Radiation on the Mammalian Hematopoietic System

12. SCIENTIFIC OR TECH AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	07 66	NA	OTHER | DA

16. PROCURE. METHOD	17. CONTRACT/GRANT: a. NUMBER, b. TYPE, c. DATE, d. AMOUNT	18. RESOURCES EST.	c. PROFESSIONAL MAN YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	18
		CURRENT FY 68	0	0

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS: Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS: US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV.: Rose, LTC L. R.	INVESTIGATOR: PRINCIPAL: Parr, W. H., Ph.D. ASSOCIATE: Dedrick, CPT R. S.
TEL: 202-OX 66082	TEL: 502-45149 TYPE: DA
21. TECHNOLOGY UTILIZATION: NA	22. COORDINATION: NA

23. KEYWORDS
Laser; Anemia; Leukopenia; Fracture; Radiation Biology; Radiation

24.

25. (U) Tech Objective - To investigate the acute and chronic effects of laser irradiation on the mammalian hematopoietic and related systems.

(U) Approach - An attempt will be made to describe the mechanism by which individual blood elements are altered by exposure to a 6943 Å laser beam. Changes will be related to power density and time of exposure in order to determine specific threshold values. The results of these studies will be applied in in vivo studies by utilizing an extracorporeal circuit. The mechanism by which marrow containing bones are fractured by an incident laser beam will be investigated and an effort will be made to quantify this phenomenon.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - None. This work was terminated because of the transfer of one of the principal investigators.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. COMSEC OR COMSEC RELATED ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CFY 01	

DD FORM 1 AUG 66 1498A (Items 1 to 26 identical to NASA Form 1322)

B71R 01 104 (cont)

Detail Sheet # 1

(U) Progress:

1) Investigations appraising the side effects associated with lased blood in the circulatory system indicate that a large percentage of in vitro lased (13 j/cm^2) red cells reinjected into the donor dog are cleared from the peripheral circulation within the first two hours or less. Preliminary studies showed little or no effect on whole blood lased with energy densities from 5 - 10 j/cm^2. 2) Isolated rat bones were fractured with energy densities of 190 j/cm^2, and bone marrow extruded from the ends of the bones (no fractures evident) at approximately one-half the preceding dose. Discoloration of the bone occurred at 40 j/cm^2. Transducers were acquired and calibrated to measure intramedullary pressure produced by the incident laser energy.

Publications and/or Presentations:

None.

Selected Bibliography:

Goldman, L., D. Blaney, D. Kindel, D. Richfield, P. Owens and E. Homan. Effect of the laser beam on the skin. III. Exposure of cytological preparations. J. Invest. Dermatol. 42: 247, 1964.

Weissman, S. M., T. A. Waldmann, and N. I. Berlin. Quantitative measurement of erythropoiesis in the dog. Amer. J. Physiol. 198: 183, 1960.

Herbert, J. C. and N. P. Page. The sequestration of erythrocytes in irradiated dogs. USNRDL-TR-1051, 29 Jul 1966.

Cooper, M. and C. A. Owens. Labeling human erythrocytes with radiochronium. J. Lab. Clin. Med. 47: 67, 1956.

RESEARCH AND TECHNOLOGY RESUME		3. GOVT ACCESSION	4. AGENCY ACCESSION	5. REPORT CONTROL SYMBOL
			DA 0A 6105	CSCRD-103

6. DATE OF RESUME	7. KIND OF RESUME	8. SECURITY	9. REGRADING	10. RELEASE LIMITATION	11. LEVEL OF RESUME
14 09 66	C. TERMINATED 12 08 66	U U (NOT / END)	NA	NL	A. WORK UNIT

12a. CURRENT NUMBER/CODE	12b. PRIOR NUMBER/CODE
61145011 3A014501B71R 01 105	NO CHANGE

13. TITLE
(U) Effects of Laser Radiation on Active Transport in Living Membranes

14. SCIENTIFIC OR TECH. AREA	15. START DATE	16. CRIT. COMPL. DATE	17. FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	07 66	08 67	OTHER DA

18. PROCURE. METHOD	19. CONTRACT/GRANT		20. RESOURCES EST.	PROFESSIONAL MAN YEARS	21. FUNDS (In thousands)
	a. NUMBER	c. DATE			
C. In-House	b. TYPE	NA d. AMOUNT	PRIOR FY 66	0	0
			CURRENT FY 67	1	7

22. GOVT LAB/INSTALLATION/ACTIVITY	23. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE Davis, CPT T. L.
TEL. 202-OX 66082	TEL 502-45749 TYPE DA

24. TECHNOLOGY UTILIZATION	25. COORDINATION
NA	NA

26. KEYWORDS
Laser; Membranes; Active Transport

27. (U) Tech Objective - Effect of laser exposure on ion transport in living membranes.

(U) Approach - Isolated frog corneas and segments of frog skin are mounted in Using type chambers and the electrical potential difference and short circuit current measured. The tissues are then lased with a ruby laser (6943 Å).

(U) Progress (1 Jul 66 - 12 Aug 66) - 1) Cornea. Immediately post-lasing there are large increases in the short circuit current (which is equivalent to the active chloride transport) and a transient decrease in the potential difference. In the steady state 1 hour post-lasing the short circuit current was still an average of 18% above control levels. These increases in current appear to be cumulative with repeated lasing of the same cornea. 2) Frog skin. There is a net increase in the short circuit current (which is equivalent to the active sodium transport) following lasing of the endothelial side of the skin with little effect on the potential difference. Lasing of the epithelial side produces a 60% average decrease in potential differences with no effect on the short circuit current.

These changes are of a different nature from those of simply heating the tissue and bathing fluids which give a linear decrease in short circuit current and potential difference. Recovery from heating is to about 60% of control levels.

It appears that ruby laser radiation is producing a sustained increase in the active transport of chloride ions in the cornea and sodium and potassium ions in the frog skin. These findings are consistent with reversible and irreversible alteration in the permeability of the membranes involved.

This work was terminated on the transfer of the investigator.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. SUBJECT CODE
☐ a. CONFIG OR ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT
35. EST. FUNDS (In thousands)	36.
CPYR	

DD FORM 1 AUG 64 1498A (Items 1 to 24 identical to AMSC Form 323)

B71R 01 105 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Photophysiology, edited by A. C. Giese, Vols. I and II. New York: Academic Press, 1964.

Rehm, W. S., T. L. Davis, C. Chandler, E. Gohmann, Jr. and A. Bashirelahi. Frog gastric mucosae bathed in chloride-free solutions. Amer. J. Physiol. 204: 233-242, 1963.

RESEARCH AND TECHNOLOGY RESUME			2 GOVT ACCESSION	3 AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 6106	CSGRD-103
4 DATE OF RESUME	5 KIND OF RESUME	6 SECURITY	7 REGRADING	8 RELEASE LIMITATION	9 LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NJ	A. WORK UNIT

10a. CURRENT NUMBER/CODE
61145011 3A014501B71R 01 275

10b PRIOR NUMBER/CODE
NO CHANGE

11. TITLE
(U) Laser Effects on Performance

12 SCIENTIFIC OR TECH. AREA	13 START DATE	14 CRIT. COMPL. DATE	15 FUNDING AGENCY
002600 Biology 009600 Masers and Lasers	12 66	NA	OTHER DA

16 PROCURE. METHOD	17 CONTRACT/GRANT a NUMBER c TYPE	d DATE e AMOUNT	18 RESOURCES EST	a PROFESSIONAL MAN YEARS	b FUNDS (In thousands)
C. In-House		NA	PRIOR FY 67	1	33
			CURRENT FY 68		

19 GOVT LAB/INSTALLATION/ACTIVITY
NAME
ADDRESS Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20315
REP. INDIV. Rose, LTC L. R.
TEL 202-OX 66082

20 PERFORMING ORGANIZATION
NAME
ADDRESS US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE Revusky, S. H., Ph. D.
TEL 502-43145 TYPE DA

21 TECHNOLOGY UTILIZATION
NA

22 COORDINATION
NA

23. KEYWORDS Laser, Animal Studies; Discrimination Learning; Injury, Poisoning, Allergy, Shock and Related Conditions

24.

(U) Tech Objective - To detect effects of laser irradiation on performance.

(U) Approach - To develop stimulus discrimination techniques which will be sensitive to laser irradiation utilizing those techniques apparently sensitive to other stressors as a starting point.

(U) Progress (1 Apr 67 - 30 Jun 67) - Our first hypothesis was that low doses of laser irradiation would increase rate of response in the presence of cues which indicate that reward will not be received. It has not been substantiated. It did seem that there was a reduction in rate of response to cues which indicate the availability of reward, but further investigation indicated that this apparent effect was an artifact of the anesthesia required to subdue the animal prior to laser exposure. Thus, we will have to proceed in two directions. We will use higher doses of laser irradiation and the training of animals will be much more extensive in order to secure more sensitive and reliable pre-irradiation baselines. About five rats should be ready for irradiation after another 3 weeks of daily 70 minute sessions of training. By September, we hope to have tested about a dozen rats.

27. COMMUNICATIONS SECURITY	28.	29 OSD CODE	30 BUDGET CODE
☐ a. COMSEC RELATED ☒ b. NOT RELATED		BR	1

31. MISSION OBJECTIVE	32 PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST FUNDS (In thousands)	36.
CY 67	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1332)

B71R 01 275 (cont)

Detail Sheet # 1

(U) Progress:

If an animal becomes sick after it eats something, it will develop an aversion to whatever it ate. In the case of X-irradiation, such food aversions are the single most sensitive behavioral technique for the detection of symptomatology in animals since such aversions occur if irradiation at 10% of the LD-50 follows food consumption. Thus, it seemed possible that a similar technique might permit detection of laser injury. Pilot work on this possibility has provided basic experimental design data. Edema, a frequent consequence of laser injury, was produced in rats by intraperitoneal injection of isotonic glucose after they had consumed saccharin solution. This alone did not produce aversion. Sodium pentobarbital injection into rats after they had consumed saccharin solution also did not produce aversion. Thus, anesthesia can probably be used in conjunction with detection of laser injury by means of food aversions. (The failure of some potent physiological assaults to produce food aversions led us to make sure we could obtain X-ray produced aversion under the setting factors in our laboratory; we could obtain them.) Thus, this technique used with scheduled laser irradiations conceivably will detect specific behavioral responses to laser irradiation as well as general stress disturbances.

Publications and/or Presentations:

Revusky, S. H. Cold acclimatization in hairless mice measured by behavioral thermoregulation. Psychon. Sci. 6: 209-210, 1966; USAMRL Report No. 673, 1966 (DDC AD No. 645084).

Revusky, S. H. An electro-mechanical flip-flop with applications to counting, timing, and randomization. J. exp. Anal. Behav. 9: 431-434, 1966; USAMRL Report No. 675, 1966 (DDC AD No. 643607).

Revusky, S. H. Aversions to saccharin produced by post-ingestive nausea; implications to drive theory. Presented at the Psychonomic Society meeting, St. Louis, Mo., 29 Oct 1966.

Revusky, S. H. Some inferential statistics which are relatively compatible with an individual organism methodology. Army Office of Research and Development Report 66-2: 299-312, 1966.

B71R 01 275 (cont)

Detail Sheet # 2

Revusky, S. H. Hunger level during food consumption: effects on subsequent preference. Psychon. Sci. 7: 109-110, 1967; USAMRL Report No. 681, 1966 (DDC AD No. 645207).

Revusky, S. H. and E. W. Bedarf. Association of illness with the prior consumption of novel foods. Science, 155: 219-220, 1967; USAMRL Report No. 694, 1966 (DDC AD No. 645205).

Revusky, S. H. Hunger: its relationship to an amount-of-reinforcement discrimination. Presented at the Psychology Colloquim of Emory University, Atlanta, Ga., 23 Jan 1967.

Revusky, S. H. Control of feeding behavior by the delayed consequences of ingestion. Presented at the Psychology Colloquim of the Mental Health Research Institute, University of Michigan, Ann Arbor, Mich., 3 Feb 1967.

Revusky, S. H. Some statistical treatments compatible with individual organism methodology. J. exp. Anal. Behav. 10: 319-330, 1967; USAMRL Report No. 716, 1967 (DDC AD No. 646751).

Revusky, S. H. Glucagon injection as an aversion event. Presented at the Midwestern Psychological Association meeting, Chicago, Ill., 5 May 1967; USAMRL Report No. 723, 1967.

Revusky, S. H. and Frank DeVenuto. Attempt to transfer aversion to saccharin solution by injection of RNA from trained to naive rats. USAMRL Report No. 724, 1967 (DDC AD No. 649985).

Revusky, S. H. Aversion to sucrose produced by subsequent X-irradiation: temporal and dosage parameters. Presented at the Eastern Psychological Association meeting, Boston, Mass., 7 Apr 1967; USAMRL Report No. 740, 1967.

Revusky, S. H. A feedback theory of hunger. Presented at the Psychology Colloquim, University of Louisville, Louisville, Ky., 13 Apr 1967.

B71R 01 275 (cont)

Detail Sheet # 3

Revusky, S. H. Feeding behavior conceived as a multiple schedule. Presented at the Psychology Colloquim, Arizona State University, Tempe, Ariz., 15 Apr 1967.

Revusky, S. H. Reward value theory of the effects of deprivation on performance. Presented at the Psychology Colloquim, University of Washington, Seattle, Wash., 16 Apr 1967.

Selected Bibliography:

Garcia, J., F. R. Ervin, and R. A. Koelling. Learning with prolonged delay of reinforcement. Psychon. Sci. 5: 121-122, 1966.

Garcia, J. and R. A. Koelling. Radiation of cue to consequence in avoidance learning. Psychon. Sci. 4: 123-124, 1966.

LeMagnen, J. Le control sensorial dah la regulation de l'apport alimentarie. L'Obesite, Expansion Scientifique, Paris, 1963, pp. 147-171.

Revusky, S. H. and E. W. Bedarf. Association of illness with prior consumption of novel food. Science, 155: 219-220, 1967.

Revusky, S. H. Some statistical treatments compatible with individual organism methodology. J. exper. Anal. Behav. 10: 319-330, 1967.

RESEARCH AND TECHNOLOGY RESUME			3. GOVT ACCESSION	4. AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 6074	CSCRD-103
5. DATE OF RESUME: 01 07 67	6. KIND OF RESUME: D. CHANGE 24 04 67	7. SECURITY: RPT U / RMK U	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A. WORK UNIT

10a. CURRENT NUMBER/CODE: 61145011 3A014501B71R 01 276

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Instrumentation Design

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002400 Bioengineering 009600 Masers & Lasers	07 65	NA	OTHER DA

16. PROCURE METHOD	17. CONTRACT/GRANT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	a. DATE / b. NUMBER / c. TYPE: NA / d. AMOUNT	PRIOR FY 67	1	29
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS: Headquarters US Army Medical Res & Dev Command Washington, D. C.	ADDRESS: US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV: Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE: Rosenbaum, J. C., Jr.
TEL: 202-OX 66082	TEL: 502-45749 TYPE: DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Laser; Instrumentation; Electromagnetic Radiation; Energy Transducers

24.

(U) Tech Objective - To design and develop specialized instruments for use in research on the biological effects of radiations, and to provide instrumentation, measurement techniques, calibrations and specialized instrument maintenance in support of such research.

25. (U) Approach - 1) To develop techniques for the application of transducers and associated instrumentation in order to monitor instantaneous thermal transients and pressure changes in biological systems resulting from absorbed laser energy. 2) To develop a device for the absolute measurement and continuous monitoring of laser energy. 3) To incorporate modifications to improve the versatility and over-all laser system efficiency.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - 1) A constant flow calorimeter using a glass body and a silver chloride window has been developed to monitor CW laser output at 10.6 μ. Additional calorimeters are in various stages of design and development with absolute calibration pending delivery of ordered standards. 2) Mechanisms to control and measure pulsed outputs, approximately .1 - 60 sec in length, to .01 sec, have been installed in the CO_2 laser. 3) Modifications to include neodymium and CO_2 "Q" switching are awaiting delivery of ordered components. 4) Pulse forming networks have been installed providing a selection of 12 flash lamp pulse lengths varying from approximately 1 millisecond to 5 milliseconds.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED b. NOT COMSEC RELATED		BR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPY41	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1122)

B71R 01 276 (cont)

Detail Sheet # 1

(U) Progress:

1) Calorimeters of various design, with and without constant flow capabilities, incorporating such features as modified metallic cones, selective window material and absorbing fluids for specific spectral response have been constructed. Additional calorimeters are in various stages of design and development with absolute calibration pending delivery of ordered standards. 2) Mechanisms to control and measure pulsed outputs, approximately 0.1 - 60 sec in length have been installed in the CO_2 laser. 3) Modifications providing a "Q" switch mode for the ruby laser have been completed. "Q" switch capabilities at neodymium and CO_2 wavelengths are awaiting delivery of ordered components. 4) Pulse forming networks have been installed providing a selection of 12 pulse lengths varying, for ruby, from approximately 0.4 to 4.0 msec with a peak power of approximately 85 kw.

Publications and/or Presentations:

None.

Selected Bibliography:

Eisenman, W. L., R. L. Bates and J. D. Merriam. Black radiation detector. J. Opt. Soc. Amer. 53: 729-734, 1963.

Scott, B. F. Fabrication and performance of cone calorimeters for laser energy measurements. J. Sci. Inst. 43: 685-687, 1966.

Forsythe, W. E. Measurement of Radiant Energy. New York: McGraw-Hill, 1937.

Project No. 3A014501B74C	Basic Research in Performance Effectiveness
Task No. 00	Basic Research in Performance Effectiveness
Work Unit No. 030	Audition and Auditory Perception

Investigators (FY 1967):

#030 M. Loeb, Ph.D.
J. L. Fletcher, Lt Colonel, MSC
W. J. Gunn, B.S.
J. N. Cronholm, M.S.
J. L. Hatfield, Major, MSC
D. L. Kohfeld, Captain, MSC

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6085	CSCRD-103
4. DATE OF RESUME: 01 07 67	5. KIND OF RESUME: D. CHANGE 24 04 67	6. SECURITY: U U	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A. WORK UNIT

10A. SUBJECT NUMBER/CODE: 61145011 3A014501B74C 00 030

10B. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Audition and Auditory Perception

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
013400 Psychology (individual & group behavior) 012900 Physiology	01 55	NA	OTHER (DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST. PRIOR FY	19. CUMULATIVE MAN-YEARS	20. FUNDS (in thousands)
C. In-House	NA	67	2	58
		CURRENT FY 68		

21. GOVT LAB/INSTALLATION/ACTIVITY
NAME:
ADDRESS: Headquarters
US Army Medical Res & Dev Command
Washington, D. C. 20315
RESP. INDIV. Hedlund, LTC James L.
TEL 202-OX 66670

22. PERFORMING ORGANIZATION
NAME:
ADDRESS: US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATOR(S) PRINCIPAL: Loeb, M., Ph. D.
ASSOCIATE: Fletcher, LTC J. L.
Hatfield, MAJ J. L.
TEL 502-42052 TYPE DA

31. TECHNOLOGY UTILIZATION	32. COORDINATION
NA	NA

33. KEYWORDS: Audition; Perception; Physiological; Acoustics; Psychoacoustics; Psychophysics; Electrophysiology; Middle Ear Function; Vigilance

34. (U) Tech Objective - To determine the mechanisms by which the human observer processes auditory information and to identify optimum auditory displays.

(U) Approach - Research is in two areas; 1) middle ear function; 2) auditory perception, e.g., vigilance, the utilization of intensity and temporal cues, the role of prior experience, auditory localization, and masking.

35. (U) Progress (1 Apr 67 - 30 Jun 67) - Experiments on conditioning and inhibition of the acoustic reflex have generally been negativ . This is some evidence that attention to a contra-aural stimulus changes the magnit de of the acoustic reflex. Apparatus for localization study has been completed and a f rst stage of evaluation is complete. Experiments on effects of signal and stimulus rate on vigilance suggest that the latter is more important. Subjects responding to several signal levels perform similarly to those responding to one. An experiment on changing signal rate is completed, and data are being analyzed. A model for vigilance is being constructed. Loeb, M. and R. P. Smith. The relation of induced tinnitus to physical characteristics of the inducing stimuli. USAMRL Rep. No. 729, 10 May 67--in press, J. Acoust. Soc. Amer.; Cronholm, J. N. Information as a criterion of goodness of fit: exact critical values for the case of equiprobable alternatives. USAMRL Rep. No. 689, 19 Apr 67 (AD 650324); Tsuchitani, Chiyeko and J. C. Boudreau. Single unit analysis of cat superior olive S-segment with tonal stimuli. USAMRL Rep. No. 734, 9 Jun 67--J. Neurophysiol. 29: 684-697, 1966.

37. COMMUNICATIONS SECURITY	38.	39. GSD CODE	40. BUDGET CODE
☐ CRYPTO RELATED ☒ NOT CRYPTO RELATED		NR	1
41. MISSION OBJECTIVE: NA		42. [illegible]: NA	
43. RESPONSIBLE AGENCY	44. SPECIAL EQUIPMENT		
45. GOVT. FUNDS (in thousands) FY 68	46.		

DD FORM 1498A (1 AUG 66) (Formerly 1 AUG 58 which may be used) (USAF Form 1132)

B74C 00 030 (cont)

Detail Sheet # 1

(U) Progress:

Recent experiments on auditory vigilance suggest that performance while attending to signals of several intensities closely resembles that while attending to a single level. Experiments on changes of signal rate within a session are continuing. Preliminary studies of the effect on acoustic reflex (AR) function of attending to a faint auditory stimulus indicate that AR functioning is enhanced. In a study on relationships for detection of auditory and visual stimuli, it was concluded that there are correlations of indices of criteria for responding and of sensitivity when the tasks were made sufficiently similar. An experiment on the role of the pinna in auditory localization is planned for the near future.

Publications and/or Presentations:

Binford, J. R. and M. Loeb. Changes within and over repeated sessions in criterion and effective sensitivity in an auditory vigilance task. J. exp. Psychol. 72: 339-345, 1966.

Cronholm, J. N. Information a[illegible] criterion of goodness of fit: exact critical values for the case of equiprobable alternatives. USAMRL Report No. 689, 1967 (DDC AD No. 650324); presented at Psychonomic Society meeting, St. Louis, Mo., 27-29 Oct 1966.

Cronholm, J. N. The chi square test of goodness of fit: exact critical values for the case of equiprobable alternatives. USAMRL Report No. 710, 1966 (DDC AD No. 645905).

Gunn, W. J. and M. Loeb. Correlation of performance on visual and auditory detection tasks. Amer. J. Psychol. 80: 236-242, 1967; USAMRL Report No. 713, 1967 (DDC AD No. 647539).

Loeb, M., I. Behar, and J. S. Warm. Cross-modal correlations of the perceived durations of auditory and visual stimuli. Psychon. Sci. 6(2): 87, 1966; USAMRL Report No. 695, 1966 (DDC AD No. 645076).

B74C 00 030 (cont)

Detail Sheet # 2

Loeb, M. and R. P. Smith. The relation of induced tinnitus to physical characteristics of the inducing stimulus. USAMRL Report No. 729, 1967 (DDC AD No. 652706).

Loeb, M. and J. R. Binford. Variation in performance on auditory and visual monitoring tasks as a function of signal and carrier frequencies. Presented (by Loeb) at Psychonomic Society meeting. St. Louis, Mo., 27-29 Oct 1966.

Smith, R. P., M. Loeb, J. L. Fletcher, and D. M. Thomas. The effect of moderate doses of curare on certain auditory functions. Acta Oto-laryngol. 62: 101-108, 1966.

Warm, J. S., E. Foulke, and M. Loeb. The influence of stimulus modality and duration on changes in temporal judgments over trials. Amer. J. Psychol. 79: 628-631, 1966.

Tsuchitani, Chiyeko, and J. C. Boudreau. Single unit analysis of cat superior olive S-segment with tonal stimuli. J. Neurophysiol. 29: 684-697, 1966; USAMRL Report No. 734, 1967.

Selected Bibliography:

Broadbent, D. E. Perception and Communication. Los Angeles: Pergamon, 1958.

Green, D. M. and J. A. Swets. Signal Detection and Psychophysics. New York: John Wiley and Sons, 1966

Jerger, J. F. (Ed.). Modern Developments in Audiology. New York: Academic Press, 1963.

Rosenblith, W. A. (Ed.). Sensory Communication. New York: John Wiley and Sons, 1961.

von Békésy, Georg. Experiments in Hearing. New York: McGraw-Hill, 1960.

Wever, E. G. and M. Lawrence. Physiological Acoustics. Princeton, N. J.: Princeton University Press, 1954.

Project No. 3A025601A819	Army Aviation Medicine
Task No. 00	Army Aviation Medicine
Work Unit No. 015	The Measurement, Composition, and Stability of Complex Skills
Work Unit No. 016	Disorientation and Performance
Work Unit No. 017	Traumatic Origins of Hearing Loss

Investigators (FY 1967):

#015 M. J. Herbert, Ph. D.
M. R. Harris, Captain, MSC
J. L. Hatfield, Major, MSC

#016 J. H. Brown, Ph. D.
J. E. Marshall, Captain, MSC

#017 J. L. Fletcher, Lt Colonel, MSC
M. Loeb, Ph. D.
I. Behar, Ph. D.
W. J. Gunn, B. S.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6087	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A819 00 015	NO CHANGE

11. TITLE
(U) The Measurement, Composition, and Stability of Complex Skills

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. ORIT. COMPL. DATE	15. FUNDING AGENCY
007500 Human Factors Engineering	06 56	NA	OTHER , DA

16. PROCURE MENT CODE	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST. a. PROFESSIONAL MAN YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67 2	52
		CURRENT FY 68	

19. GOV'T LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Cutting, LTC R. T.	INVESTIGATORS PRINCIPAL Herbert, M. J., Ph. D.
TEL 202-OX 64458	ASSOCIATE Harris, CPT M. R. Hatfield, MAJ J. L.
	TEL 502-47545 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS Ability; Aptitude; Driving; Factor Analysis; Fatigue; Human Factors; Motor Skills; Performance Decrement; Psychomotor; Skill Analysis

24. (U) Tech Objective - To develop procedures for measuring the components of complex skills; to identify basic abilities both general and specific to a variety of skills; to observe revealed ability patterns under conditions of practice and stress to test the regression hypothesis in performance decrement.

25. (U) Approach - The major skill under investigation is vehicle driving. A cross-validation design utilizing a field-based driving test battery permits the correlation of actual vehicle manipulation, with laboratory apparatus and printed-test measures to provide a more stringently controlled check on field performance. Performance variation associated with practice and with extended task exposure is programmed for both vehicle driving and for the artificial tasks in the laboratory.

(U) Progress (1 Apr 67 - 30 Jun 67) - Data from 35 laboratory skill tests are at Purdue Computing Science Center. Subject N on above tests, plus the revised Driving Performance Battery, has increased to 60. Sixty-three of a projected 200 Transportation drivers have been tested on the Battery in the study of traffic violators and accident involvement. An inexpensive and trouble-free performance task as a reference measure of Spatial Orientation has been developed. A limited version of the Driving Performance Battery has been constructed at the Primary Helicopter Training School at Fort Wolters, Texas, and is now operational. This will be used to investigate the relationship of driving skills to helicopter flying skills.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED ☒ b. INT RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPVH	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1121)

A819 00 015 (cont)

Detail Sheet # 1

(U) Progress:

Performance by 107 subjects on 35 lab-based apparatus and printed tests of a number of skill aptitudes has been correlated and factor-analyzed. From the analysis, two papers are in preparation. One reports a new and more effective measure of response orientation; the other reports on a new, simple test of aptitudes best measured by the SAM two-hand coordination apparatus in the past. The second phase of a hand-steadiness study was aborted because of a failure in recording apparatus. This completion is programmed for FY 1968. A test of kinesthetic sensitivity was evaluated on an N of 60. Test reliability was considered too low, and led to a change in test procedure from simultaneous to successive judgment of presented weights. An N of 61 subjects has been reached at reporting date. A subject N of 73 has been reached in the vehicle-skill study based on performance on the lab-based reference measures and the revised driving performance battery. Ninety-one transportation drivers have been tested on the driving battery in the study of traffic violation. A limited version of the driving performance battery was constructed at the US Primary Helicopter Center at Fort Wolters, Texas. One-hundred three student pilots showing satisfactory flying proficiency, and 32 "failures" or "set-backs" have completed performance on the battery and on ten lab-based skill reference tests.

Publications and/or Presentations:

Herbert, M. J. Job sample skill analysis program at USAMRL. Presented at the Army Avionics Instrumentation Meeting, Philadelphia, Pa., 26-27 Oct 1966.

Selected Bibliography:

Bartlett, F. C. The measurement of human skill. Brit. Med. J. 1: 835-877, 1947.

Fleishman, E. A. Testing for psychomotor abilities by means of apparatus tests. Psych. Bull. 50: 241-262, 1953.

A819 00 015 (cont)

Detail Sheet # 2

Fleishman, E. A. and G. N. Ornstein. An analysis of pilot flying performance in terms of component abilities. J. appl. Psychol. 44: 146-155, 1960.

Floyd, W. J. and A. T. Welford. Symposium on Fatigue. London: H. K. Lewis and Co., Ltd., 1953.

Parker, J. F. and E. A. Fleishman. Ability factors and component performance measures as predictors of complex tracking behavior. Psych. Monogr. 74: 36, 1960.

Zovala, A., E. A. Locke, H. P. Van Cott, and E. A. Fleishman. The analysis of helicopter pilot performance. Amer. Inst. for Research, Washington, D. C., 1965.

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6094	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A819 00 016	NO CHANGE

11. TITLE
(U) Disorientation and Performance

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
012900 Environmental Biology 002600 Biology 002700 Bionics	07 65	NA	OTHER, DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	31
		CURRENT FY 68		

19. GOVT LAB INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV Cutting, LTC R. T.	INVESTIGATORS PRINCIPAL ASSOCIATE Brown, J. H., Ph. D. Wolfe, J. W., Ph. D.
TEL 202-OX 64458	TEL 502-43646 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Vestibular Apparatus; Caloric Stimulation; Angular Acceleration/Body Rotation; Psychophysiology; Visual Interaction; Disorientation; Space Perception

24. (U) Tech Objective - The disorienting effects of angular and linear accelerations are a disruptive influence to performance of various kinds during military operations. This project is a long-range effort to provide the fundamental information required to anticipate future problems and to solve contemporary problems stemming from spatial disorientation.

(U) Approach - The important problems of spatial disorientation and performance are approached via psychophysiological and behavioral techniques. Specific dependent variables include the electrical recording of eye movements, computer analysis of the vestibulo-ocular reflex, and psychophysical judgments. Stimulation of the vestibular apparatus is accomplished by both accelerative and caloric stimulation under experimental conditions emphasizing interaction with vision and other sensory systems.

(U) Progress (1 Apr 67 - 30 Jun 67) - Two experiments related to the generalization of habituation between different acceleration environments were completed. An experiment specifying the nature and extent of adaptation has also been completed. These data clearly show that disorientation (erroneous perceptions of movement) can result not only from very intense stimulation of the vestibular system, but also from very weak stimulation. Several baseline studies utilizing aviator personnel assigned to Ft Knox have been initiated. In addition, normal subjects are presently being tested to determine if significant threshold shifts occur concomitant with habituation. Brown, J. H. Facts and theories of vertigo. Presented at Symposium on Vertigo as a Problem in Aerospace Medicine, Johnsville, Pa., 7-9 Feb 67; Marshall, J. E. Generalization of nystagmic habituation as a function of stimulus intensity. Presented at the 38th Annual Meeting of the Eastern Psychological Association, Boston, Mass., 6-8 Apr 67.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. CLOSELY RELATED ☒ b. NOT RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands) CPFF	36.

DD FORM 1 AUG 68 1498A (Items 1 to 36 identical to NASA Form 1332)

A819 00 C16 (cont)

Detail Sheet # 1

(U) Progress:

The assessment of subjective velocity via psychophysical techniques is continuing and a study utilizing auditory cross-modality matching was completed and has been submitted for publication. The habituation of vestibular responses to interacting stimuli was examined and found to provide a reliable means of assessing asymmetry. Two experiments determining the degree to which habituation will generalize to higher and lower intensities of angular acceleration were completed. Experiments specifying the nature and extent of adaptation in both nystagmic and subjective responses to angular acceleration have also been completed. Several baseline studies utilizing aviation personnel assigned to Fort Knox have been initiated. In addition, subjects are presently being tested to determine if threshold shifts occur with habituation.

Psychophysical scaling of subjective velocity (auditory cross-modality estimates of angular velocity during constant angular acceleration) validated the exponent of 1.0 found previously with numerical magnitude estimates. Comparable adaptation was found and it was concluded that this adaptation is a real phenomenon and of potential significance as one form of disorientation.

The extent to which habituation will transfer or generalize to higher and lower stimulus intensities and durations was determined. As with other parameters of habituation, a high degree of specificity of habituation was found. That is, there appears to be only limited generalization of habituation to stimuli that are either more or less intense or longer or shorter in duration than the habituating stimulus. However, there was an asymmetrical generalization gradient such that relatively more transfer was found from higher intensity and longer duration stimuli to accelerations of lower intensity and shorter duration than vice versa.

Arrangements have been made with the Aviation Group presently assigned to Fort Knox for volunteers to serve as subjects in several baseline studies comparing the vestibular sensitivity of Army rotary and fixed wing pilots with the sensitivity of both normal subjects and pilots of high-performance aircraft. Both nystagmic and a variety of subjective responses, including threshold judgments and magnitude

estimates, are being recorded under several experimental conditions. These data will be related to total hours flight experience, present flying activity, and a number of other measures to be taken from the Army Disorientation Questionnaire currently being sent to all aviation units by USABAR.

In a study recently completed and currently being analyzed, subjects were tested to determine if threshold shifts are evident after extensive exposure to an accelerative environment.

Modifications of the large turntable are in progress in order to experimentally approach the question of whether "fatigue" increases one's susceptibility to disorientation. A classical view of fatigue is that it represents a regression from a state in which the individual functions primarily with reflex-like motor skills to a condition where he is more dependent upon his perceptual environment. Since disorientation is primarily a perceptual phenomenon, it is anticipated that a fatigued individual will be more likely to become disoriented.

Publications and/or Presentations:

Brown, J. H. Magnitude estimation of angular velocity during passive rotation. J. exp. Psychol. 72(2): 169-172, 1966; USAMRL Report No. 701, 1966 (DDC AD No. 645075).

Brown, J. H. and J. E. Marshall. Drug control of arousal and nystagmic habituation in cat. Presented (by Brown) at Psychonomic Society meeting, St. Louis, Mo., 27-29 Oct 1966.

Brown, J. H. Facts and theories of vertigo. Presented at Symposium on Vertigo as a Problem in Aerospace Medicine, Johnsville, Pa., 7-9 Feb 1967.

Brown, J. H. Interacting vestibular stimuli and nystagmic habituation. Acta Oto-laryngol. 62: 341-350, 1966; USAMRL Report No. 715, 1967.

A819 00 016 (cont)

Detail Sheet # 3

Brown, J. H. Cross-modality estimation of angular velocity. USAMRL Report No. 738, 1967.

Marshall, J. E. and J. H. Brown. Visual-arousal interaction and specificity of nystagmic habituation. Aerospace Med. 38(6): 597-599, 1967; USAMRL Report No. 688, 1966 (DDC AD No. 645926).

Marshall, J. E. and J. H. Brown. Generalization of nystagmic habituation as a function of stimulus intensity. Presented (by Marshall) at the 38th annual meeting of the Eastern Psychological Association, Boston, Mass., 6-8 Apr 1967.

Selected Bibliography:

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Brown, J. H. and G. H. Crampton. Quantification of the human nystagmic response to angular acceleration. Prediction formulae and nomograph. Acta Oto-laryngol. (Stockh.), 58: 555-564, 1964.

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Mowrer, O. H. The modification of vestibular nystagmus by means of repeated elicitation. Comp. Psychol. Monogr. 9: 1-48, 1934.

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Wood, C. D. Antimotion sickness drugs for aerospace. NASA SP-77, The Role of the Vestibular Organs in the Exploration of Space, 1965, pp. 365-371.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6062	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A819 00 017	NO CHANGE

11. TITLE:
(U) Traumatic Origins of Hearing Loss

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
007500 Human Factors Engineering 012900 Physiology	01 55	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST. a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67: 2	42
		CURRENT FY 68:	

19. GOVT LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Cutting, LTC R. T.	INVESTIGATORS PRINCIPAL Fletcher, LTC J. L.
TEL. 202-OX 66458	ASSOCIATE Loeb, M., Ph. D. Behar, I., Ph. D.
	TEL 502-42052 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Noise Exposure; Hearing Loss; Acoustic Trauma; Audition; Psychophysiology; Impulse Noise; Continuous Noise; Susceptibility; Ear Protection

24. (U) Tech Objective - To determine and study the relations between noise exposure and hearing loss to predict susceptibility to noise induced hearing loss.

25. (U) Approach - Method has involved experimental investigation of parameters of sound as related to production of temporary threshold shifts (TTS) in humans; permanent threshold shifts (PTS) are being investigated in human and animal subjects.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Work is continuing on TTS from impulse noise, varying pulse duration while holding SPL constant. Consultation is underway with White Sands Missile Test Center on noise-missile problems. A study has just been completed comparing monkey and human TTS following exposure to octave band noise. Preliminary results indicate that the monkeys are more sensitive to noise exposure. Impulse noise exposure will be studied next. Study is beginning with hospital patients, on temporary and permanent effects on human hearing of certain ototoxic drugs. Preliminary reports on central effects on auditory fatigue and on the monkey experiments were presented at the Acoustical Society meeting in April 1967.

27. COMMUNICATIONS SECUR. TY	28.	29. OSD CODE	30. BUDGET CODE
a. CLASSIFIED ☐ b. NOT CLASSIFIED ☒		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CFY 68	

DD FORM 1 AUG 67 1498A (Items 1 to 36 identical to NASA Form 1122)

A819 00 017 (cont)

Detail Sheet # 1

(U) Progress:

Data are being collected on TTS from impulse exposure with SPL held constant while varying pulse duration. Field evaluation of the CHAPARRAL missile system is underway at White Sands Missile Test Center. Effect of meningitis on high frequency hearing was studied and reported. Work continues on monkey and human TTS from octave band exposure. Investigation is being started of high frequency effects of ototoxic drug therapy in humans, joint research with University of Colorado Medical Center. Some experiments on central effects on TTS are being completed and experiments on recovery from high frequency hearing loss are underway.

Publications and/or Presentations:

Fletcher, J. L. and A. B. Cairns. Recovery from impulse noise induced acoustic trauma. J. aud. Res. 7: 35-39, 1967; USAMRL Report No. 686, 1966 (DDC AD No. 645898).

Fletcher, J. L. and M. Loeb. An exploratory study on the effect of pulse duration on temporary threshold shift produced by impulse noise. USAMRL Report No. 680, 1967 (DDC AD No. 647540); presented (by Fletcher) at Acoustical Society of America meeting, Los Angeles, Calif., 2-5 Nov 1966.

Fletcher, J. L., A. B. Cairns, F. G. Collins, and J. Endicott. High frequency hearing following meningitis. USAMRL Report No. 711, 1966 (DDC AD No. 645906).

Fletcher, J. L., M. Loeb, and J. L. Hatfield. Noise evaluation of the 20-ton rough terrain crane. USAMRL Letter Report No. 12, 1966.

Loeb, M., J. L. Fletcher, and C. E. Guthrie. A preliminary evaluation of the hazard to hearing produced by the CHAPARRAL missile, Feb 1967.

Loeb, M. and I. Behar. Temporary threshold shifts in rhesus monkeys produced by exposure to octave bands of noise. Presented

(by Loeb) at Acoustical Society of America meeting, Washington, D.C., 19-22 Apr 1967.

Smith, R. P. and M. Loeb. Several experiments on central factors in auditory fatigue. Presented (by Smith) at Acoustical Society of America meeting, New York, N. Y., 5 Apr 1967.

Zislis, T. and J. L. Fletcher. Relation of high frequency thresholds to age and sex. J. aud. Res. 6: 189-198, 1966; USAMRL Report No. 702, 1966 (DDC AD No. 645082).

Selected Bibliography:

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Kryter, K. D. and G. R. Garinther. Auditory effects of acoustic impulses from firearms. Acta Oto-laryngol. Suppl. 211, 1966.

Kryter, K. D., W. D. Ward, J. D. Miller, and D. H. Eldredge. Hazardous exposure to intermittent and steady-state noise. J. acoust. Soc. Amer. 39: 451-464, 1966.

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Murray, N. E. and G. Reid. Hearing loss due to gunblast. Med. J. Australia, 611: 1946.

Ward, W. D. Effect of temporal spacing on temporary threshold shift from impulses. J. acoust. Soc. Amer. 34: 1230-1232, 1962.

Project No. 3A025601A821	Combat Surgery
Task No. 00	Combat Surgery
Work Unit No. 155	Study of Bank Blood Preserved in Acid-Citrate-Dextrose and Acid-Citrate-Dextrose with Adenine After Forty-Two Days of Storage
Work Unit No. 156	Study of Group O Blood Donors in the Military to Delineate Titers and Technic of Natural and Immune Antibodies Applicable to a Safe, Wide-scale Employment of O Blood to A, B, AB and O Recipients
Work Unit No. 157	Study of Transport and Logistic Problems of Stored Whole Blood and Blood Components in the Military
Work Unit No. 158	Evaluation of Automated, Semiautomated, and Other Techniques Involved in Military Blood Banking
Work Unit No. 159	Evaluation of Mass Blood Grouping in the Military Services by Automated and Semiautomated Methods
Work Unit No. 160	Blood Groups, Blood Group Substances and Chromosome Studies of Laboratory Animals
Work Unit No. 161	Biochemical Alterations of Human Red Blood Cells in Cold Storage
Work Unit No. 162	Alteration in Protein Components of Stored Red Blood Cells
Work Unit No. 163	Pasteurella pestis and Human Blood Cross-Reacting Antigens
Work Unit No. 164	Evaluation of Methods and Models for Measuring Transfusion Effects and Practices

Investigators (FY 1967):

#155	C. E. Shields, Lt Colonel, MC F. R. Camp, Jr., Lt Colonel, MSC L. J. Reed, Captain, MC L. G. Dauber, Captain, MC H. F. Bunn, Captain, MC R. W. Bull, Captain, VC S. D. Litwin, Captain, MC
#156	F. R. Camp, Jr., Lt Colonel, MSC C. E. Shields, Lt Colonel, MC L. J. Reed, Captain, MC L. G. Dauber, Captain, MC S. D. Litwin, Captain, MC
#157	C. E. Shields, Lt Colonel, MC F. R. Camp, Jr., Lt Colonel, MSC L. J. Reed, Captain, MC L. G. Dauber, Captain, MC
#158	F. R. Camp, Jr., Lt Colonel, MSC C. E. Shields, MC
#159	F. R. Camp, Jr., Lt Colonel, MSC C. E. Shields, Lt Colonel, MC
#160	R. W. Bull, Captain, VC R. S. Dedrick, Captain, VC H. F. Bunn, Captain, MC
#161	F. DeVenuto, Ph. D.
#162	W. F. Kocholaty, Ph. D. J. L. Gray, B. S. M. Edith Ledford, A. B.
#163	A. J. Luzzio, Ph. D.
#164	H. F. Bunn, Captain, MC S. D. Litwin, Captain, MC C. E. Shields, Lt Colonel, MC

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6095	CSGRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A821 00 155	NO CHANGE

11. TITLE (U) Study of Bank Blood Preserved in Acid-Citrate-Dextrose and Acid-Citrate-Dextrose with Adenine After Forty-Two Days of Storage

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine	11 65	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In Thousands)
C. In-House	NA	PRIOR FY 67	3	152
		CURRENT FY 68		

19. GOVT LAB INSTALLATION. ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV Rose, LTC L. R.	INVESTIGATOR(S) PRINCIPAL ASSOCIATE Shields, LTC C. E. Camp, LTC F. R., Jr. Reed, CPT L. J.
TEL 202-OX 66082	TEL 502-43046 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS
Blood Preservation; Blood Transfusion; Adenine

24. (U) Tech Objective - Research activities will examine the effects of adenine added to ACD (acid-citrate-dextrose) stored blood on cell survival as measured in the recipient. Whole, human blood stored at 6°C in ACD solution has a shelf life of 21 days. Extension of this dating period to 42 days or more is anticipated in this study with ACD and adenine.

(U) Approach - Various programs will involve study of volunteer donors and recipients who will receive various combinations of anticoagulants with and without adenine. Studies will include measurement of survival, various biochemical facets in the stored units, donors and recipients.

(U) Progress (1 Apr 67 - 30 Jun 67) - One program has been completed in which ACD and CPD anticoagulant with and without adenine have been compared after storage for 28, 35 or 42 days. This was prepared for publication and presented at the American Association of Blood Banks Meeting in Oct 1966. A second program consisting of autologous and homologous transfusions under varied conditions representing type specific and/or universal donor transfusion is in progress. The first portion involving 186 recipients receiving blood collected in ACD has been completed. On the basis of these findings, a report has been submitted supporting the extension of shelf life of ACD blood from 21 to 28 days. The second phase of the program is studying the properties of adenine in ACD solution. An additional program has been added to evaluate different collection volumes, as part of the over-all program involved in whole blood preservation and also as a factor in the transport of blood. This latter program has been planned and extended to include other areas and hospitals in this country and overseas.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED ☒ b. NOT RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands) CY+1	36.

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1339)

A821 00 155 (cont)

Detail Sheet # 1

(U) Progress:

A study comparing ACD and CPD anticoagulant with and without adenine following storage for 28, 35 or 42 days has been carried out. Results of the investigation were presented at the American Association of Blood Banks meeting in October 1966 and have been prepared for publication. This study is also described in USAMRL Report No. 719, dated 21 March 1967. A second program has consisted of giving autologous and homologous transfusions under varied conditions representing type specific and/or universal donor transfusions. A total of 185 recipients are in the process of being studied and reports are being prepared. A program to investigate blood transfusions with and without adenine in Vietnam was initiated and scheduled to be carried out in April; however, this was postponed. Supplementary and ancillary studies are being planned in preparation for patient studies in various hospitals in the country.

Publications and/or Presentations:

Bunn, Howard F. A proposed mechanism for the glomerular filtration of hemoglobin. Presented at the American Society of Clinical Investigation meeting, Atlantic City, N. J., 30 Apr - 3 May 1967.

Bunn, Howard F. The effect of sulfhydryl reagents on the binding of human hemoglobin to haptoglobin. USAMRL Report No. 735, 1967.

Camp, Frank R., Jr. and Charles E. Shields. Comparison of blood preservation after storage in ACD or CPD solutions supplemented with adenine. Presented (by Shields) at American Association of Blood Banks meeting, Los Angeles, Calif., 25-28 Oct 1966.

Camp, Frank R., Jr. Served as instructor at course entitled "Advances in Medical Laboratory Procedures;" presented talk on "Blood Bank Operations," Walter Reed Army Institute of Research, 15 Nov 1966.

Camp, Frank R., Jr. Comparison of blood preservation after storage in ACD or CPD solutions supplemented with adenine. Presented

before the Interdepartmental Committee on National Blood Program Research, The Pentagon, Washington, D. C., 12 Dec 1966.

Camp, Frank R., Jr. "The Universal Donor." Presented at a meeting on Preventive Medicine and Laboratory Officers' Symposium, Walter Reed Army Institute of Research, 6 Apr 1967.

Shields, Charles E. and Frank R. Camp, Jr. Effect of immunizations on blood group antibody production. USAMRL Report No. 708, 1966 (DDC AD No. 647146).

Shields, Charles E. "Basic Concept of Red Cell Symposium." Represented the Army in a review of the Armed Forces blood program, Chelsea, Mass., 17-18 Nov 1966.

Shields, Charles E. Role of Fort Knox adenine studies in the Army blood program. Presented at Conference on Adenine, Chicago, Ill., for Surgical Research Branch, USAMRDC, 18-19 Jan 1967; presented at the combined conference with WRAIR and USAMRDC, 5-7 Feb 1967; presented at the Ad Hoc Committee and Symposium by the National Resource Committee, 23 Mar 1967.

Shields, Charles E. and Frank R. Camp, Jr. Comparison studies of whole blood stored in ACD and CPD and with adenine. USAMRL Report No. 719, 1967.

Shields, Charles E. Survival of ACD blood after serial storage. USAMRL Report No. 741, 1967.

Shields, Charles E. Progress of Fort Knox adenine studies. Presented in San Juan, Puerto Rico, 13-16 Jun 1967.

Werline, Madonna M., Charles E. Shields, and Frank R. Camp, Jr. A safe crossmatch of whole blood with an extended shelf life. Read by title at the American Association of Blood Banks meeting, Los Angeles, Calif., 25-28 Oct 1966.

Detail Sheet # 3

Selected Bibliography:

Berlin, N. I. Quantitation of erythropoiesis. In: Sunderman, F. W. and F. W. Sunderman, Jr. (Eds.). Hemoglobin. Its Precursors and Metabolites. Philadelphia: J. B. Lippincott Co., 1964.

Bishop, C. Damage to red cells due to their collection and storage in ACD. Transfusion, 3: 263, 1963.

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Bowman, H. S. Red cell preservation in citrate phosphate dextrose and in ACD. Transfusion, 3: 364, 1963.

Bunag, R. D. Influence of a pyrimidopyrimidine derivative on deamination of adenosine by blood. Circ. Res. 15: 83, 1964.

Burkle, J. S. Radio-isotopic measurement of erythrocyte life span. In: Sunderman, F. W. and F. W. Sunderman, Jr. (Eds.). Hemoglobin. Its Precursors and Metabolites. Philadelphia: J. B. Lippincott, Co., 1964.

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Cline, M. J. and N. I. Berlin. Simultaneous measurement of the survival of a population of erythrocytes with the use of labelled diisopropylfluorophosphate. J. Lab. Clin. Med. 61: 249, 1963.

Crouch, S. K. and C. Bishop. Maintenance of ATP in stored blood by adenosine and inosine. Transfusion, 3: 349, 1963.

Crowley, L. V. Variations in levels of transaminases and lactic dehydrogenase in bank blood. Clin. Chem. 8: 626, 1962.

de Verdier, C. H., L. Garby, J. Killander, M. Hjelm, and C. F. Hogman. Relation between the age of red cells labelled with

radio-iron and hemolysis induced by mechanical trauma and rapid freezing-thawing. Vox Sang. 8: 660, 1963.

de Verdier, C. H., L. Garby, M. Hjelm, and C. G. Hogman. Adenine in blood preservation: post-transfusion viability after transfusion. Transfusion, 3: 356, 1963.

Eadie, G. S., I. W. Brown and W. W. Smith. Relation between storage time of erythrocytes and their percent viability after transfusion. Transfusion, 3: 356 1963.

Garby, L. and L. Thoren. Transfer of magnesium and citrate between red cells and plasma during storage in acid citrate-glucose solution. J. Clin. Lab. Invest. 14: 392, 1962.

Gibson, J. G., W. P. Murphy, W. A. Scheitlin, and S. B. Rees. Influence of extracellular fractions involved in the collection of blood in ACD on maintenance of red cell viability during refrigerated storage. Amer. J. Clin. Path. 26: 855, 1956.

Gibson, J. G. and W. A. Scheitlin. Method employing radioactive chromium for assaying the viability of human erythrocytes returned to the circulation after refrigerated storage. J. Lab. Clin. Med. 46: 679, 1955.

Haut, A., G. R. Tudhope, G. E. Cartwright, and M. M. Wintrobe. Studies on the osmotic fragility of incubated normal and abnormal red blood cells. J. Clin. Invest. 41: 1766, 1962.

Lange, R. D., W. H. Crosby, D. M. Donohue, C. A. Finch, J. G. Gibson, T. J. McManus, and M. A. Strumia. Effect of inosine on red cell preservation. J. Clin. Invest. 37: 1485, 1958.

Milles, G., H. Langston, and W. Dalessandro. Experiences with auto-transfusion. Surg. Gynec. Obstet. 115: 689, 1962.

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A821 00 155 (cont)

Detail Sheet # 5

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Sacks, J. Isotopic Tracers in Biochemistry and Physiology. New York: McGraw-Hill, 1953.

Sandler, J. L., T. F. Nealon, and J. H. Gibbon. Restoration of stored bank blood to biochemical normalcy. J.A.M.A. 179: 115, 1962.

Schecter, D. C. and H. Swan. Biochemical alterations of preserved blood. Arch. Surg. 84: 269, 1962.

Schrier, S. L. Studies of the metabolism of human erythrocyte membrane. J. Clin. Invest. 42: 756, 1963.

Shafer, A. W. and G. Bartlett. Phosphorylated carbohydrate intermediates of the human erythrocytes during storage in ACD. J. Clin. Invest. 41: 690, 1962.

Shafer, A. W. and J. S. Trombold. Phosphorylated carbohydrate intermediates of the human erythrocytes during storage in acid citrate dextrose. Transfusion, 4: 120, 1964.

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Simon, E. R., R. G. Chapman, and C. A. Finch. Adenine in red cell preservation. J. Clin. Invest. 41: 351, 1962.

Smith, E. L., R. A. Huggins, L. Kraintz, R. A. Seibert, and S. Deavers. Determination of cell volume in massive transfusions using Fe^{59} and Cr^{51}. Amer. J. Physiol. 186: 97, 1956.

A821 00 155 (cont)

Detail Sheet # 6

Strumia, M. M. (Ed.). General Principles of Blood Transfusion. Republished from Transfusion, 1963.

The Technical Method and Procedures of the American Association of Blood Banks.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6096	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U (DOD) U (DOE)	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A821 00 156	NO CHANGE

11. TITLE (U) Study of Gp O Blood Donors in the Mil to Delineate Titers & Technic of Natural & Immune Antibodies Appl to a Safe, Widescale Empl of O Blood to A, B, AB & O Recipients

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine	04 66	NA	OTHER DA

16. PROCUR. METHOD	17. CONTRACT/GRANT a. NUMBER b. TYPE c. DATE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	62
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D.C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL Camp, LTC F. R., Jr.
TEL 202-OX 66082	ASSOCIATE Shields, LTC C. E.
	TEL 502-41251 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS

Blood; Blood Banks; Blood Donors; Blood Groups; Blood Transfusion

24. (U) Tech Objective - To identify the group O donor whose blood can be transfused indiscriminately in battlefield and/or other emergency situations. Identification of substances interfering with group O blood will be carried out and once these are identified they will be monitored to eliminate the contaminating substance.

(U) Approach - 1st Stage: Blood will be collected from a representative military population and the presence of and titers of natural and immune anti-A and anti-B hemolysins in this blood will be assayed. Calculations of antibody titers will be based on standard blood group serology procedures. 2d Stage: After being assayed, these bloods will be transfused into A, B, and AB recipients and monitored for adverse reactions. The titers causing no reactions will be declared safe.

(U) Progress (1 Apr 67 - 30 Jun 67) - Identification of several levels of group O interference has been made in various portions of the military population. This has been clearly related to the plague immunizations and has been reported at the AMA and the Int. Soc. of Blood Transfusion. During the course of investigation of other vaccines, hemolysins to group A were also found in influenza. This is planned for presentation at the AABB, Oct 67, with the following conclusion: Hemolysin inhibition assays of influenza and plague vaccines revealed A substance concentrations of 12 μg/ml and 68 μg/ml, respectively. These results suggest that: 1) minute amounts of A substance stimulate ABO antibody production, 2) since influenza vaccine is freely and frequently prescribed, resultant antibody production may contribute to the "naturally-occurring" ABO antibodies, 3) hemolysins may be the most sensitive of the ABO antibodies to immune stimulation, 4) administration of these vaccines to potential universal donors, young females and particularly pregnant women may be undesirable. The identification of the primary substance as plague vaccine has allowed rescheduling of the immunization program, providing a greater pool of useful group O donors of the Army Blood Program. Preliminary studies of transfusion of group O blood into non-group O recipient is in progress with subsequent work extending these studies using blood with know antibody levels.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. COMSEC RELATED ☒ b. NOT RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CFY 67	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1139)

A821 00 156 (cont)

Detail Sheet # 1

(U) Progress:

Identification of several levels of group O interference has been made in various portions of the military population. This has been clearly related to the plague immunizations and has been reported at the American Medical Association meeting and the International Society of Blood Transfusion. The identification of the primary substance as plague vaccine has allowed rescheduling of the immunization program providing a greater pool of useful group O donors of the Army Blood Program. Transfusion of group O blood into non-group O recipients has been carried out in the first phase and is still under analysis.

Publications and/or Presentations:

Camp, Frank R., Jr. and Charles E. Shields. Military blood banking - identification of the group O Universal Donor for transfusion of A, B and AB recipients - an enigma of two decades. Presented (by Camp) at the 11th Congress of the International Society of Blood Transfusion, Sydney, Australia, 24-29 Aug 1966; USAMRL Report No. 678, 1966 (DDC No. 645447); Mil. Med. 132(6): 426-429, 1967.

Camp, Frank R., Jr. and Charles E. Shields. The Universal Donor in the military - a reappraisal. Presented (by Camp) at the 11th Congress of the International Society of Blood Transfusion, Sydney, Australia, 24-29 Aug 1966.

Camp, Frank R., Jr. and Charles E. Shields. Alteration of blood group titers in group O soldiers and the effect on the "Universal Donor" pool. Read by title at the American Association of Blood Banks meeting, Los Angeles, Calif., 25-28 Oct 1966.

Camp, Frank R., Jr. Military blood banking and immunohematology - continuous training for service through research. Presented at the Fort Knox Junior Science and Humanities Symposium, 31 Mar - 1 Apr 1967.

Camp, Frank R., Jr. Observations, training, and research programs in military blood banking and immunohematology. Presented

at the Kentucky Association of Blood Banks meeting, Lexington, Ky., 20 May 1967.

Shields, Charles E. and Frank R. Camp, Jr. Immune antibodies - their production and fate (effect of immunizations on blood group antibody production). Presented (by Camp) at the 11th Congress of the International Society of Blood Transfusion, Sydney, Australia, 24-29 Aug 1966.

Shields, Charles E. Role of Fort Knox adenine studies in the Army blood program. Presented at the combined conference with WRAIR and USAMRDC, 5-7 Feb 1967.

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A821 00 156 (cont)

Detail Sheet # 3

Mollison, P. L. Blood-group antibodies and red-cell destruction. Brit. Med. J. 2(5160): 1123-1130, 1959.

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Currie, Julius A., John D. Marshall, Jr., and Dan Crozier. The detection of Pasteurella pseudotuberculosis antibodies by the microhemagglutination test. J. Infect. Dis. 116(2): 117-122, 1965.

Jandl, James H. Mechanisms of antibody-induced red cell destruction. Haematologica, 9: 35-46, 1965.

RESEARCH AND TECHNOLOGY RESUME			3. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 60	CSCRD-103
4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A02560 A821 00 157

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Study of Transport and Logistic Problems of Stored Whole Blood and Blood Components in the Military

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine	04 66	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	.NA	PRIOR FY 67	1	36
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION ACTIVITY
NAME
ADDRESS Headquarters
US Army Medical Res & Dev Command
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RESP. INDIV. Rose, LTC L. R.
TEL 202-OX 66082

20. PERFORMING ORGANIZATION
NAME
ADDRESS US Army Medical Res Laboratory
Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE Shields, LTC C. E.
Camp, LTC F. R., Jr.
TEL 502-43046 TYPE: DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Blood; Blood Banks; Blood Donors; Equipment and Supplies; Transportation

24. (U) Tech Objective - To establish improvements in logistical practices for the handling of and supply of blood and components to military field units.

(U) Approach - 1st Stage: a. A systematic and comprehensive survey will be made of methods being utilized in current military operations. b. This information will be scrutinized and evaluated with a view of defining problem areas. 2d Stage: Field work units will be established for the express purpose of attempting to clarify and develop improvements in the problem areas specifically delineated in Stage 1.

(U) Progress (1 Apr 67 - 30 Jun 67) - Shipments of blood and plasma have been received from Viet Nam, transported through channels of the Military Blood Program Agency. Every unit was inspected visually and examined using in vitro tests. It was clearly apparent that shipping damage had occurred both involving the exterior package and the internal contents. This was a particular problem with the frozen plasma because of the cracking of the plastic container. Because of demand to ship such materials, extensive study has been undertaken to study new containers and protective envelopes. This will partly include testing the materials during weekly shipments of fresh frozen plasma to Walter Reed General Hospital. The results of the Viet Nam shipments are being prepared in a formal laboratory report, though the initial first shipment report has been reported already to the Military Blood Program Agency. Studies are continuing on the survival of wet ice in shipping containers at various temperature ranges. Red cell survival will be measured following stationary exposure to temperature, short range transport and long range transport. As part of the transportation program, different methods of delivery, including air drop, are being evaluated. One system involving cushioning the blood with water was without significant success. Newly designed containers introduced by a manufacturer to compete with the standard container has been studied, yielding approximately 70-90% survival of box contents.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. CLASSIFIED ☐ b. UNCLASSIFIED ☒		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPY+1	

DD FORM 1 AUG 66 1498A (Items 1 to 36 identical to NASA Form 1132)

A821 00 157 (cont)

Detail Sheet # 1

(U) Progress:

Equipment: Special cards containing specific dried blood group identification reagents produced by an American manufacturer were tested. Tests of veracity, avidity and reliability of reagents and packaging were made under simulated combat conditions, such as high heat-high humidity; high heat-low humidity; and various cold environments as well as following prolonged storage in high heat or total water immersion. The data indicated that the use of the equipment was not simple and was subject to environmental effects as well as being inefficient in terms of technician time. The major blood group reagents were satisfactory, but the Rh factor identification was unsatisfactory.

These cards were compared to those obtained from an European manufacturer. A report on this has been prepared and accepted for publication in Military Medicine.

Publications and/or Presentations:

Camp, Frank R., Jr. and Charles E. Shields. Blood components - their preparation and use. J. Ky. Med. Assoc. 64: 873-877, 1966.

Shields, Charles E. and Frank R. Camp, Jr. Testing of blood grouping cards under field-type conditions. USAMRL Report No. 739, 1967.

Selected Bibliography:

Kendrick, D. B., Brigadier General, MC, USA. Blood Program in World War II. Office of The Surgeon General, Department of the Army, Washington, D. C., 1964.

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Spencer, L. E. and M. S. Nix, Jr. Evaluation of "Tuffy" air lock container for free fall delivery of whole blood. USAARU Report No. 66-4, US Army Aeromedical Research Unit, Fort Rucker, Ala., Apr 1966.

RESEARCH AND TECHNOLOGY RESUME			3. GOVT ACCESSION	4. AGENCY ACCESSION	REPORT CONTROL SYMBOL
				DA 0A 6098	CSGRD-103
5. DATE OF RESUME: 01 07 67	6. KIND OF RESUME: D. CHANGE 24 04 67	7. SECURITY: RPT U / WSR U	8. REGRADING: NA	9. RELEASE LIMITATION: NL	10. LEVEL OF RESUME: A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A025601A821 00 158

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Evaluation of Automated, Semiautomated, and Other Techniques Involved in Military Blood Banking

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CMPT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine	04 66	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST. a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67: 1	13
		CURRENT FY 68:	

19. GOV'T LAB/INSTALLATION/ACTIVITY
NAME:
ADDRESS: Headquarters
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TEL: 202-OX 66082

20. PERFORMING ORGANIZATION
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INVESTIGATORS PRINCIPAL: Camp, LTC F. R., Jr.
ASSOCIATE: Shields, LTC C. E.
TEL: 502-41251 TYPE: DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Blood; Blood Banks; Blood Groups; Automation; Automatic Data Processing; Data Acquisition; Equipment and Supplies

24. (U) Tech Objective - To facilitate and improve routine blood banking practices by utilizing automated and semiautomated technics.

25. (U) Approach - 1st Stage: A systematic and comprehensive survey will be made of available automated laboratory technics which might conceivably be utilized in blood banking practices. 2d Stage: Laboratory test situations will be employed to evaluate the usefulness and reliability of each automated technic which suggests promise.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - Standardization of determining blood group O donors having anti-A and anti-B natural occurring agglutinins lower than a titer of 1:200 has long been a problem among serological laboratories. A technic employing a semiautomated dilution system has been devised, tested and found to be simple and reliable at the Blood Transfusion Division, USAMRL, Fort Knox. The system employs precision microcapillaries calibrated to contain 10 ml (microliters) or lambdas. They are manufactured by the Drummond Scientific Co., Broomhall, Pa., and come as 100 disposable micro-pipettes called "MICROCAPS."

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED ☒ b. NOT RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPFF:	

DD FORM 1 AUG 66 1498A (Items 1 to 36 identical to NASA Form 1122)

A821 00 158 (cont)

Detail Sheet # 1

(U) Progress:

A system for control, distribution and prediction of requirements for blood logistics has been investigated. An applicable system of data retrieval using small computers and data processing systems in the field and in headquarters units for control, distribution and prediction of requirements of critical medical supplies, such as blood, appears capable of programming with modification, so that it performs the blood inventory control and prediction operations required at field stations and headquarters units.

Publications and/or Presentations:

Camp, Frank R., Jr. and Charles E. Shields. Screening procedures employing semiautomated and fully automated technics. Presented (by Camp) at the 11th Congress of the International Society of Blood Transfusion, Sydney, Australia, 24-29 Aug 1966.

Shields, Charles E. and Frank R. Camp, Jr. Testing of blood grouping cards under field-type conditions. USAMRL Report No. 739, 1967.

Selected Bibliography:

Rosenfield, R. E., I. O. Szymanski and S. Kochwa. Quantitative hemagglutination that is relatively independent of Rh antigens and antibodies. Cold Spring Harbor Symposium on Quantitative Biology, Vol. 29, 1964.

Vargues, Robert. Use of the autoanalyzer for study and understanding of complement fixation reactions. International Technicon Symposium, Paris, Oct 1964.

Vargues, Robert. Automation in complement fixation reactions. Technicon Symposium, New York City, Sep 1965.

A821 00 158 (cont)

Detail Sheet # 2

Rosenfield, Richard E. and Gladys V. Haber. Detection and measurement of homologous human hemagglutinins. Technicon Symposium, New York City, Sep 1965.

Unger, P. and O. Ramgren. Automated analysis in blood-group serology and haematology. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 959-963, 1965.

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Rosenfield, R. E., Irma O. Szymanski, Gladys V. Haber, and S. Kochwa. Automated methods for the detection and measurement of hemagglutination. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 985-991, 1965.

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RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6099	CSGRD-103
4. DATE OF RESUME: 01 07 67	5. KIND OF RESUME: D. CHANGE 24 04 67	6. SECURITY: U U	7. REGRADING: NA	8. RELEASE LIMITATION: NL	9. LEVEL OF RESUME: A.WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A025601A821 00 159

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Evaluation of Mass Blood Grouping in the Military Services by Automated and Semiautomated Methods

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine	04 66	NA	OTHER , DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	10
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY
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20. PERFORMING ORGANIZATION
NAME:
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INVESTIGATORS PRINCIPAL: Camp, LTC F. R., Jr.
ASSOCIATE: Shields, LTC C. E.
TEL: 502-41251 TYPE: DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS: Blood; Blood Banks; Blood Groups; Automation; Automatic Data Processing; Data Acquisition

24.
(U) Tech Objective - To evaluate present automated methods for use in mass blood grouping.

(U) Approach - Set up apparatus and run simultaneous determinations using new and standard methods to compare accuracy and efficiency. Conduct a variable and continuing evaluation of blood grouping operations carried out at post and field locations separate from fixed blood bank facilities.

(U) Progress (1 Apr 67 - 30 Jun 67) - In view of changes to AR 40-3, which now requires ABO blood grouping, serum confirmation of the blood group by back typing with known A and B erythrocytes and determination of the Rh factor, places a sense of urgency in developing accurate blood grouping automation, as well as training in the acceptable system. A 15- channel autoanalyzer (Technicon) will be placed in operation at the Reception Center, Ft Knox, to perform the ABO blood group and Rh type of 1200 inductees per week. Another automated system is being studied requiring joint studies and effort by the Blood Transfusion Division, USAMRL, and Berkeley Scientific Laboratories, Berkeley, Calif. Evaluation continues of a quantitative hemagglutinating autoanalyzer (Technicon) in screening for hemagglutinins. Parallel manual testing is conducted employing saline, high-protein and anti-human globulin technics. Some antigen-antibody reactions require special conditions on the autoanalyzer for detection. The mechanical collection of whole blood has been studied to eliminate "short-fills" and "over-fills" which result in improper ACD to blood ratios. The study in progress involves evaluation of a semiautomatic blood collection apparatus employing a vacuum system to regulate both blood flow and volume.

25. COMMUNICATIONS SECURITY: ☐ a. COMSEC DR COMSEC RELATED ☒ b. NOT RELATED	26.	28. DSU CODE: AR	29. BUDGET CODE: 1
27. MISSION OBJECTIVE: NA		32. PARTICIPATION: NA	
33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT		
35. EST. FUNDS (In thousands) CY+1	36.		

DD FORM AUG 64 1498A (Items 1 to 36 identical to NASA Form 1122)

A821 00 159 (cont)

Detail Sheet # 1

(U) Progress:

The Technicon Autoanalyzer system of blood grouping has been studied for accuracy and reproducibility. Certain parts have been found to be delicate in construction and require constant replacement. Many critical parts must be kept on hand for immediate replacement to keep the autoanalyzer in operation.

Cooperative studies with Dade Reagents, Inc., are continuing to produce standard reagents for the autoanalyzer that are licensed by the Division of Biologics Standards, National Institutes of Health.

In view of changes to AR 40-3, which now require ABO blood grouping, serum confirmation of the blood group by back typing with known A and B erythrocytes and determination of the Rh factor places a sense of urgency in developing accurate blood grouping automation, as well as training in the acceptable system.

Another automated system is being studied requiring joint studies and effort by the Blood Transfusion Division, USAMRL, and Berkeley Scientific Laboratories, Berkeley, California.

Publications and/or Presentations:

Camp, Frank R., Jr. and Charles E. Shields. Screening procedures employing semiautomated and fully automated technics. Presented (by Camp) at the 11th Congress of the International Society of Blood Transfusion, Sydney, Australia, 24-29 Aug 1966; USAMRL Report No. 707, 1966 (DDC AD No. 647538).

Selected Bibliography:

Reissigl, H. Fortschritte durch die Verwendung von Plastikmaterial zur Blutkonservierung. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1006-1015, 1965.

A821 00 159 (cont)

Detail Sheet # 2

Steigner, K. F. Zusammensetzbare geschlossene Kunststoffbeutelsysteme zur Konservierung und Aufbereitung von Erythrozyten. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1016-1021, 1965.

Gibbs, Mary B. and F. R. Camp, Jr. A simple device for washing erythrocytes for the antiglobulin test. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1022-1029, 1965.

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Polak, A. Experiences with a simple modification of the slide technique of Rh testing with Papain. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1036-1039, 1965.

Fotino, Marilena, Marcela Boia, and Marie Danielescu. A new simple slide test for salivary secretor status. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1040-1042, 1965.

Brun, G. C. Twelve years' experience with the Eldoncard methods. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1043-1046, 1965.

Hansen, P. An apparatus for measurement of 25 µl blood for routine haemoglobin determination. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1047, 1965.

Langfelder, M., G. Sik, and K. Zs[illegible]nsky. Über gewaschene Erythrozytensedimente. Proc. 10th Congress Int. Soc. Blood Transfusion, Stockholm, 1964; pp. 1048-1050, 1965.

RESEARCH AND TECHNOLOGY RESUME		2. GOV'T ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6102	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U U	NA	NL	A.WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A821 00 160	NO CHANGE

11. TITLE: (U) Blood Groups, Blood Group Substances and Chromosome Studies of Laboratory Animals

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CMPT. COMP'L. DATE	15. FUNDING AGENCY
003500 Clinical Medicine (Lab Animal)	08 66	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousand
C. In-House	NA	PRIOR FY 67	1	5
		CURRENT FY 68		

19. GOV'T LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE Bull, CPT R. W. Hysell, CPT D. K. Neves, CPT A. J.
TEL 202-OX 66082	TEL 502-43937 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS

Animal, Laboratory; Blood; Blood Groups; Chromosomes

24. (U) Tech Objective - To investigate the blood groups, blood group substances, carbohydrate metabolism, erythropoietic mechanisms and endocrine blood and body fluid levels of laboratory animals, with particular emphasis on the canine and subhuman primate. Establish chromosome karotypes of laboratory animals. Knowledge of this nature is imperative for the use of laboratory animals in transfusion studies.

25. (U) Approach - Blood samples will be taken from subhuman primates and other laboratory animals as they reside in this laboratory's colony. Production of specific primate, canine and other laboratory animal erythrocyte antiserum will be instigated in either their respective species by isoimmunization or by immunization of rabbits. Biochemical assay of blood and body fluid endocrine levels as associated with carbohydrate and erythropoietic pathways will be conducted on selected laboratory animals. Tissue culture and direct cytological will be used for elucidation of chromosome karotypes.

26. (U) Progress (1 Apr 67 - 30 Jun 67) - A paper is in preparation on the hematological, blood chemistry values and osmotic fragilities of subhuman primates. Selected Papio spp. are to be immunized for the production of species specific RBC antiserum. The isoimmunization of selected dogs is nearing completion for the production of canine A_1, A and D RBC typing serum. A survey is underway on RBC glucose-6-phosphate dehydrogenase, as well as true blood glucose levels, in subhuman primates.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC OR COMSEC RELATED ☐ b. NOT RELATED ☒		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
FY	

DD FORM 1 AUG 64 1498A (Items 1 to 3 identical to NAVY Form 1222)

A821 00 160 (cont)

Detail Sheet # 1

(U) Progress:

The progress in FY 1967 on the hematological values, blood chemistry values and osmotic fragilities of Cercocebus spp. and Papio spp. of primates has been quite successful. The manuscript and bibliography of the results is in preparation for publication. As a result of this work, normal clinical laboratory values for this colony's primates are established and employed in routine and experimental evaluation of the animal committed to current project work.

Several areas of further interest have come to light as a result of this study. The comparison of primate leukocyte morphology to human leukocytes indicates that the primates commonly have hypersegmentation of polymorphonuclear (pmns) leukocytes. The significance of such findings is that hypersegmentation of pmns is a criteria in the diagnosis of vitamin B_{12} and Folic Acid deficiencies in man. It is hoped that next year we will be able to determine if our primates either have a B_{12} deficiency or a different control on leukocyte maturation which could normally lead to hypersegmentation. During the tabulation and comparison of the blood glucose levels of baboons, it was found that the animals were divided into those with extremely high blood glucose level or lower than normal levels. A study of the situation indicates that quite possibly there is an impaired glucose tolerance in primates. This, coupled with a pilot survey on glucose-6-phosphate dehydrogenase content of erythrocytes, further indicates that subhuman primates carbohydrate metabolism possibly follows different pathways and should be investigated for numerous reasons.

In the past year, this division has been able to produce an erythrocyte antiserum in rabbits against the cells of one baboon. The utilization of this antiserum in various immunohematologic techniques has enabled the separation of the rest of the baboon colony into two groups. Those groups having an erythrocyte factor similar to the baboon used to produce the antiserum or those lacking the factor. With this foundation and current investigations, it will be possible to isoimmunize baboons which are deficient in the erythrocyte factor and thereby increase the specificity of the antiserum. Concurrently with

the erythrocyte antiserum production has been the production of antiserum against whole baboon serum. It is now hoped that by fractionation of the baboon serum and further rabbit immunization with the components to be able to produce specific antiserum which will be of value in detection of possible incomplete blood groups of baboons.

With the assistance of Dr. Scott N. Swisher, Rochester Medical School, this laboratory's canine colony was typed for the four known canine blood groups (A_2, A, C, and D). This information was subsequently utilized in the production of canine erythrocyte typing serum which is presently ready to be harvested and purified for distribution to individuals in need of this typing serum.

The results of all of these investigations have been twofold. First, it furthered our basic knowledge of this laboratory's animal colony and secondly, as this laboratory progresses in the study of transfusion complications, baseline data of this nature will be imperative for the utilization of laboratory animal models.

Publications and/or Presentations:

None.

Selected Bibliography:

Allen, J. R. and L. M. Siegfried. Hematologic alterations in pregnant rhesus monkeys. Lab. Animal Care, 16(6): 465-471, 1966.

Garcia, Felix G. and Ronald D. Hunt. The hematogram of the squirrel monkey. Lab. Animal Care, 16(1): 50-51, 1966.

Krise, George M. Hematology of the normal monkey. Ann. N. Y. Acad. Sci. 85: 805-810, 1960.

Ponder, Eric, J. Franklin Yeager, and H. A. Charipper. Studies in comparative haematology. II. Primates. Quart. J. Exper. Physiol. 19: 181-195, 1929.

RESEARCH AND TECHNOLOGY RESUME		2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6107	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY (INPT / RPT)	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 14 03 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A025601A821 00 161

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Biochemical Alterations of Human Red Blood Cells in Cold Storage

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
003500 Clinical Medicine 002300 Biochemistry	03 67	NA	OTHER , DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. NUMBER / b. TYPE / c. DATE / d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	15
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY
NAME:
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TEL: 202-OX 66082

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Fort Knox, Ky. 40121
INVESTIGATORS PRINCIPAL ASSOCIATE: DeVenuto, F., Ph. D.
Morse, S. S.
Ligon, D. F.
TEL: 502-42053 TYPE: DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Blood, Red Cells; Steroid Hormones

24. (U) Tech Objective - To investigate whether anti-hemolytic steroid hormones, such as corticosterone interaction with lipoporteins of the cell membrane of erythrocytes, are able to preserve the structure integrity of such membrane and prevent or limit the breakdown of red blood cells during storage.

25. (U) Approach - Alterations of biochemical parameters of red blood cells will be studied; these will include changes in pH and protein synthetic ability and also changes in ATP, protein, hemoglobin and nucleic acid concentrations occurring in red blood cells during cold storage in acid-citrate-dextrose solutions. These data will be correlated to one another and to the time period of storage. In parallel experiments, in which corticosterone is added to the RBC suspension, the effect of this steroid in preventing or limiting such alterations will be investigated.

26. (U) Progress (14 Mar 67 - 30 Jun 67) - The effect of corticosterone on the biochemical alterations of human red blood cells during cold storage has been studied. It has been found that corticosterone inhibits the hemolysis of red blood cells but does not influence the preservation of ATP in the system. Other biochemical parameters, such as changes in hemoglobin, nucleic acids and ability to incorporate amino acids into proteins, have been investigated; the results show that the precipitate obtained at 100, 000 x g from red blood cells hemolysates catalyze the incorporation of labeled amino acid into protein at a rate proportional with the time of storage. Other data are in the process of being evaluated.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
a. COMSEC RELATED ☒ b. NOT COMSEC RELATED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands) CY/FY	36.

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 812)

A821 00 161 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Agarwal, K. N. and L. Garby. Inhibition by corticosteroids of red cell lysis in vitro. Acta Endocrinol. Suppl. 93: 3, 1964.

DeVenuto, F. Interaction of progesterone and aldosterone with red blood cells of the rat. Proc. Soc. Exper. Biol. and Med. 124: 478, 1967.

Bakerman, S. and G. Wasemiller. Studies on structural units of human erythrocyte membrane. I. Separation, isolation and partial characterization. Biochemistry, 6: 1100, 1967.

Rose, I. A. and V. B. Warms. Control of glycolysis in the human red blood cell. J. Biol. Chem. 241: 4848, 1966.

RESEARCH AND TECHNOLOGY RESUME		3. GOVT ACCESSION	4. AGENCY ACCESSION	5. SECURITY CONTROL NUMBER
			DA 0A 6108	CSCRD-103

6. DATE OF RESUME	7. KIND OF RESUME	8. SECURITY	9. REGRADING	10. RELEASE LIMITATION	11. LEVEL OF RESUME
01 07 67	D. CHANGE 21 03 67	U U	NA	NL	A. WORK UNIT

12a. CURRENT NUMBER/CODE	12b. PRIOR NUMBER/CODE
62156011 3A025601A821 00 162	NO CHANGE

13. TITLE:
(U) Alteration in Protein Components of Stored Red Blood Cells

14. SCIENTIFIC OR TECH. AREA	15. START DATE	16. CRIT. COMPL. DATE	17. FUNDING AGENCY
002300 Biochemistry 003500 Clinical Medicine 016200 Stress Physiology	03 67	NA	OTHER DA

18. PROCURE. METHOD	19. CONTRACT/GRANT a. NUMBER b. TYPE NA c. DATE d. AMOUNT	20. RESOURCES EST.	a. PROFESSIONAL MAN-YRS	b. FUNDS (In thousands)
C. In-House		PRIOR FY 67	1	11
		CURRENT FY 68		

21. GOVT LAB/INSTALLATION/ACTIVITY	22. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS: Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS: US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV: Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE: Kocholaty, W. F., Ph. D. Gray, J. L., B.S. Ledford, M. E., A.B.
TEL: 202-OX 66082	TEL: 502-44350 TYPE: DA

23. TECHNOLOGY UTILIZATION	24. COORDINATION
NA	NA

25. KEYWORDS: Blood Preservation; Cells and Cell Constituents; Blood Proteins; Hemolysis; Protein Purification; Electrophoresis; Chromatography

26. (U) Tech Objective - To investigate the nature of hemolysates obtained from red blood cells stored under a variety of conditions. To separate and characterize the major components of these hemolysates, and to correlate changes observed with time of storage.

27. (U) Approach - Hemolysates will be obtained from red cells of whole blood stored for varying periods of time under a variety of experimental conditions. The hemolysates will be subjected to moving-boundary electrophoresis to establish changes in the concentration patterns of the components. Gel or cellulose acetate electrophoresis also will be employed, as well as chromatographic techniques to separate the major components for analysis by ultracentrifugation, diffusion and amino acid content.

28. (U) Progress (21 Mar 67 - 30 Jun 67) - Hemolysates of stored red blood cells have been subjected to fractionation procedures and the soluble protein preparations chromatographed. A procedure employing pH gradient elution on a DEAE-cellulose column has been established for the separation of different types of hemoglobin and the non-hemoglobin proteins. Hemolysates of red blood cells stored for varying periods of time were investigated and the separated components examined by disc gel electrophoresis.

29. COMMUNICATIONS SECURITY	30.	31. OSD CODE	32. BUDGET CODE
a. COMSEC ☐ COMSEC RELATED ☒ b. ADP RELATED		AR	1

33. MISSION OBJECTIVE	34. PARTICIPATION
NA	NA

35. REQUESTING AGENCY	36. SPECIAL EQUIPMENT

37. EST. FUNDS (In thousands)	38.
CY 67	

DD FORM 1498A (Items 1 to 21 identical to NASA Form 1152)

A821 00 162 (cont)

Detail Sheet # 1

(U) Progress:

Hemolysates of stored red blood cells and the supernates obtained from high speed centrifugation of the hemolysates have been subjected to fractionation by anion-exchange chromatography utilizing a microgranular DEAE-cellulose column. The system employs gradient elution with a Tris-HCl buffer of decreasing pH and constant molarity. Modification of this gradient reported in studies on the heterogeneity of hemoglobin has reduced considerably the time required for elution of the constituents of the hemolysate with no apparent loss in resolution. At least two types of hemoglobin, as well as two non-hemoglobin proteins in low concentration, have been separated employing this chromatographic procedure. Small analytical columns have been used to date, and the procedure will be scaled up to preparative size to provide sufficient amounts of the separated components for more extensive analysis.

Concentration of the separated constituents has permitted preliminary examination with respect to electrophoretic mobility and homogeneity by means of disc gel electrophoresis.

Hemolysates prepared from red blood cells stored 0 to 28 days, with or without corticosterone added, have been subjected to column chromatography. No significant quantitative change attributable to time of storage has been observed in the hemolysates or their chromatographically separated constituents.

Publications and/or Presentations:

None.

Selected Bibliography:

Huisman, Titus H. J. and Andree M. Dozy. Studies on the heterogeneity of hemoglobin. IX. The use of tris-HCl buffers in the anion-exchange chromatography of hemoglobins. J. Chromatography, 19: 160, 1965.

A821 00 162 (cont)

Detail Sheet # 2

Chanutin, Alfred and R. R. Curnish. Factors influencing the electrophoretic patterns of red cell hemolysates analyzed in cacodylate buffers. Arch. Biochem. Biophys. 106: 433, 1964.

RESEARCH AND TECHNOLOGY RESUME	1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
			DA 0A 6109	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY RPT	SECURITY MTR	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
01 07 67	D. CHANGE 24 04 67	U	U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE	10b. PRIOR NUMBER/CODE
62156011 3A025601A821 00 163	NO CHANGE

11. TITLE:
(U) Pasteurella pestis and Human Blood Group Cross-Reacting Antigens

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
010100 Microbiology	03 67	NA	OTHER DA

16. PROGRAM ELEMENT, METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE	d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA		PRIOR FY 67	1	11
			CURRENT FY 68		

19. SERVICE LAB/INSTALLATION/ACTIVITY	20. PERFORMING ORGANIZATION
NAME	NAME
ADDRESS Headquarters US Army Medical Res & Dev Command Washington, D. C. 20315	ADDRESS US Army Medical Res Laboratory Fort Knox, Ky. 40121
RESP. INDIV. Rose, LTC L. R.	INVESTIGATORS PRINCIPAL ASSOCIATE Luzzio, A. J., Ph.D.
TEL 202-OX 66082	TEL 502-46645 TYPE DA

21. TECHNOLOGY UTILIZATION	22. COORDINATION
NA	NA

23. KEYWORDS
Immunology; Blood Groups; Pasteurella pestis; Antigens

24.
(U) Tech Objective - To determine the occurrence and location of human blood group-like-antigens in P. pestis, and to quantitate the hemolytic potency of serums from mammals immunized with isolated fractions of P. pestis.

(U) Approach - Sera of rabbits immunized with isolated gross fractions from P. pestis will be quantitatively assayed for groups A, B and O human red blood cell hemolysins. The analysis of samples collected at various times following immunization will establish immune response curves that will determine the induction period, peak titers, and persistence of hemolysins for each of the antigen-antibody systems studied. In addition, the data will determine whether blood group-like-antigens of P. pestis occur in the capsular or somatic portion of the cell.

(U) Progress (1 Apr 67 - 30 Jun 67) - Rabbits pre-immunized with human Group A blood cells are currently being immunized with gross fractions prepared from commercial Pasteurella pestis vaccine. Sera from normal rabbits and rabbits injected with human Group A red blood cells have been quantitatively assayed to determine the immune response curves that will be basic in characterizing the systems being studied.

27. COMMUNICATIONS SECURITY	28.	29. ORG CODE	30. BUDGET CODE
☐ CODES OR CIPHERS RELEASED ☒ NOT RELEASED		AR	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPFF:	

DD FORM 1 AUG 64 1498A (Items 1 to 28 identical to NASA Form 8332)

A821 00 163 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Kabat, E. A. and M, M. Mayer. Experimental Immunochemistry. Springfield Ill.: Charles C. Thomas, 1948.

Raffel, S. Immunity. New York: Appleton-Century-Crofts, Inc., 1961.

RESEARCH AND TECHNOLOGY RESUME

1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	4. REPORT CONTROL SYMBOL
		DA 0A 6110	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
24 07 67	D. CHANGE 24 04 67	U U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62156011 3A025601A821 00 164

10b. PRIOR NUMBER/CODE: NO CHANGE

11. TITLE: (U) Evaluation of Methods and Models for Measuring Transfusion Effects and Practices

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002300 Biochemistry 003500 Clinical Medicine 012900 Physiology	04 67	NA	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT a. DATE b. NUMBER c. TYPE d. AMOUNT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
C. In-House	NA	PRIOR FY 67	1	30
		CURRENT FY 68		

19. GOVT LAB/INSTALLATION/ACTIVITY
NAME
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RESP. INDIV: Rose, LTC L. R.
TEL: 202-OX 66082

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Litwin, CPT S. D.
Shields, LTC C. E.
TEL: 502-45348 TYPE: DA

21. TECHNOLOGY UTILIZATION: NA

22. COORDINATION: NA

23. KEYWORDS: Blood; Blood Transfusion; Transfusion Effects; Transfusion Test Methods

24. (U) Tech Objective - Develop a generally applicable testing system to measure the effects of transfusion, with and without selected additives, and to test methods and equipment used in transfusion therapy.

25. (U) Approach - Biochemical tests available will be compared to new programs and baseline values on selected animal species will be obtained. Correlation will be made between in vitro tests and in vivo survival. Once baselines are established, experimental variations will be studied. Tests in areas of immunohematology and coagulation will also be included where applicable.

26. (U) Progress (24 Apr 67 - 30 Jun 67) - Very preliminary experimentation has been carried out defining the effects of hemoglobin in the renal system suggesting that hemoglobin per se is excreted in several forms.

27. COMMUNICATIONS SECURITY	28.	29. DSD CODE	30. BUDGET CODE
☐ a. COMSEC OR COMSEC RELATED ☒ b. NOT RELATED		A	1

31. MISSION OBJECTIVE	32. PARTICIPATION
NA	NA

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands)	36.
CPFF	

DD FORM 1 AUG 64 1498A (Items 1 to 36 identical to NASA Form 1155)

A821 00 164 (cont)

Detail Sheet # 1

Publications and/or Presentations:

None.

Selected Bibliography:

Bunn, H. F. and G. D. Lubash. A controlled study of induced diuresis in barbiturate intoxication. Ann. Int. Med. 62: 246-251, 1965.

Bunn, H. F., G. D. Lubash, K. H. Stenzel, and A. Rubin. Limited success of intermittent dialysis in chronic renal disease. JAMA, 188: 785-790, 1964.

Bunn, H. F. and J. H. Jandl. Dynamic exchange of hemes between hemoglobins. J. Clin. Invest. 45: 993, 1966.

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Cadwallader, T. C. The effects of increased CS duration in extinction of a conditioned avoidance response. USAMRL Report No. 721, 1967 (DDC AD No. 649257).

Evans, W. O. "Emergence" as opposed to "the proliferation of constructs." USAMRL Report No. 684, 1966 (DDC AD No. 647147).

Flick, D. F., J. B. Scott, and R. A. Hardin. Preliminary observations on the reversal of hypovolemia with intravenous fat emulsion. Proc. Soc. Exper. Biol. and Med. 124: 793, 1967.

Flowers, H. H. A comparison of the neutralization ability of a heterologous vs. homologous coral snake (Micrurus fulvius) venom. USAMRL Report No. 714, 1967; Amer. J. Trop. Med. Hyg. 15: 1003, 1966.

Luzzio, A. J. Inhibitory properties of serum proteins on the enzymatic sequence leading to lysis of red blood cells by snake venom. USAMRL Report No. 717, 1967 (DDC AD No. 647597).

Spoerl, E. S. and W. S. Pfeiffer. Iodoacetate inhibition of galactoside transport. USAMRL Report No. 683, 1966 (DDC AD No. 645187).

*Work done under projects/tasks/work units of prior years; articles published in FY 1967.

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Third United States Army Medical Laboratory, Fort McPherson, Georgia 30330

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Fifth United States Army Medical Laboratory, 12th and Spruce Streets, St. Louis, Missouri 63102

Sixth United States Army Medical Laboratory, Fort Baker, California 94965

Commanding Officer, Medical General Laboratory (406), APO, San Francisco, California 96343

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US Army Medical Research Laboratory
Fort Knox, Kentucky 40121

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5. AUTHOR(S) (First name, middle initial, last name)

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	US Army Medical Research and Development Command, Washington, D.C. 20315

13. ABSTRACT

The research and development effort at the US Army Medical Research Laboratory, Fort Knox, Kentucky, is devoted to psychological studies of the soldier; laser radiation; methodology relating to the collection, processing, preservation, shipment and transfusion of human blood; the health of laboratory animals; and detoxification of snake venom. (U)

The progress during Fiscal Year 1967 and the current status of the various work units are reported herein. (U)

DD Form 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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Security Classification

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	ROLE	WT	ROLE	WT	ROLE	WT
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Human Factors						
Audition						
Animals						
Fibrinolysis						
Laser						
Hearing Loss						
Hormones						
Enzyme Synthesis						
Antibody						
Snake Bites						
Snakes, Poisonous						
Color Vision						
Vestibular Apparatus						
Biophysics						
Instrumentation						
Diseases ofAnimals						
Blood Banks						
Blood Donors						
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Blood Transfusion						
Adenine						
Automation						
Disorientation						
Neurophysiology						
Annual Progress Report						